The organisational culture of a ship: A description and some possible effects it has on accidents and lessons for seafaring leadership

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DECLARATION

I certify that this thesis contains no material that has been accepted for a degree or diploma by the University or any other institution, except by way of background information and duly acknowledged in the Thesis, and to the best of my knowledge and belief no material previously published or written by another person except where due acknowledgment is made in the text of the thesis.

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Abstract

This study was intended to further the understanding of organisational culture and climate on board a ship, it also explored the linkages that these two broad areas had with marine accidents. The study was designed to represent, as broadly as possible, the views of seafarers all around the world.

An extensive literature search of databases in the maritime, education and other cognate fields, revealed only two other studies that dealt with some of the issues examined by this study. The study also examined literature dealing with investigations into maritime accidents, as many of the causal factors identified by these investigations assisted the study in its examination of the organisational culture and climate of a ship.

This study addresses three key questions: What is the nature of the organisational culture aboard a ship? What is the nature of the organisational climate aboard a ship? and, Are there any aspects of organisational culture and climate that impact on the safety culture of a ship?

This thesis therefore contains descriptions of the organisational culture and climate aboard ships, to facilitate a better understanding of the environment within which ships operate. In examining these two areas this study focussed mainly upon the safety culture and climate of a ship, as the span of each of the earlier described areas was large and covered many issues.

This study used a research approach that combined elements of quantitative and qualitative methods. This mixed-mode was deemed the way to proceed as the researcher wished to utilise data gathering

approaches that have been used in both broad research approaches, i.e., a questionnaire, metaphorical analysis, and document analysis. This mixed-mode approach allowed the investigation of issues within a bounded system, but where the participants were widely dispersed and not readily accessible for extended face-to-face data gathering. The study utilised three instruments for data gathering, which generated three datasets. These datasets provided the basis on which the statistical analysis was conducted. The three instruments used in the survey were the `Maritime Culture Questionnaire' (MCQ), `Assumptions through Metaphor' (AtM) Questionnaire and the `Maritime Climate Questionnaire' (MClQ). The total number of seafarers who participated in the instrument survey was over 700 persons and like most surveys of this kind there was a slight variation in the number of respondents for each instrument.

Analysis of the datasets enabled the organisational culture aboard ship to be described comprehensively. This analysis demonstrated that Heads of Departments (HODs) and seafarers displayed either one of two distinct behavioural characteristics when they worked aboard ship. The first characteristic behaviour was the `HOD Collegial Behaviour' type, here the HOD would be positive and demonstrably supportive toward subordinates. The other characteristic behaviour was the `HOD Formalistic Behaviour' type, when displaying this type of behaviour the HOD showed indifference toward subordinates and their activities. When a HOD displayed this latter behaviour, respondents indicated that it had a negative impact on the safety climate of a ship. The addition of outcome variables to the MCQ instrument permitted linkages to be made between the organisational culture aboard ships and marine accidents. Similarly an analysis of the third dataset enabled the development of a description of the organisational climate of a ship. This examination of the organisational

climate of a ship identified situations when seafarers were likely to display the described behavioural characteristics. The study also found that it is possible that these negative behaviours were displayed more often than the positive ones. The findings of this study make recommendations that will assist in improving the safety climate on board ships.

This study makes recommendations that have relevance to personnel managers of shipping companies or ship-management companies, maritime regulatory authorities, maritime educators and Heads of Departments on board ships.

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Description of technical terms used by the Maritime Industry

This section defines some of the technical terms that the study uses when dealing with issues that concern the maritime industry.

Certificate of Class: When a ship is built according to a Classification Society's rules it is given a certificate of class attesting to this fact. For a ship to maintain its class it then has to be maintained according to a maintenance regime specified by the Classification Society.

Certificate of Competency: A country's official safety authority issues a Certificate of Competency; it certifies that a person is competent to carry out the tasks at the level for which the certificate has been awarded. Sullivan (1996) defines it as a certificate issued by the appropriate authorities confirming the competency or the efficiency of an officer of a ship for a particular grade and department. Seafarers awarded a Certificate of Competency are held responsible for any action that they may take in the course of the performance of their duties.

Certificate of Proficiency: A country's official maritime safety authority issues a Certificate of Proficiency. It certifies that a person has been trained to a satisfactory level for tasks they are required to perform, i.e., at a level for which the certificate has been awarded. Persons possessing certificates of proficiency however are only deemed to have the necessary skills to carry out a task. They cannot be held responsible for the results of their actions, as a more senior competent person must supervise all their work related activities.

Classification Society: A Classification Society is an organisation that specifies the rules governing the construction of a ship. There are many such societies around the world including Lloyds and Det Norske Veritas.

Coastal state: Unlike other forms of transport, a ship does not necessarily ply only within the territorial waters of its flag state. The vast majority of ships ply on the open oceans and in the territorial waters of other nations. When the latter occurs, the state territorial waters within which a ship is plying is known as the *coastal state*.

Collision: Includes ships lost as a result of striking or being struck by another ship, regardless of whether underway, anchored or moored.

Contact: Includes ships lost as the result of striking an external substance – but not another ship or the sea bottom. This category includes striking drilling rigs/platforms, regardless of whether in fixed position or in tow.

Deadweight: It is the difference between a vessel's displacement weight and its lightship weight. It is generally assumed to comprise the following weights: cargo, fuel, fresh-water, stores and any similar weight that has been added to the lightship weight.

Deck Officers: These seafarers are also known as Navigating Officers as they possess Certificates of Competency as either Second Mate, Chief Mate or Master. Their role is to supervise the cargo operations and navigation of a ship. They can have other duties as well, such as attending to the maintenance of life saving or fire fighting appliances, charts, medical stores, and the ship's structure. The Master is in command of the vessel and is also a Deck Officer.

Displacement: It is the total amount of water that a vessel displaces when floating. This can also be taken to mean the total weight or mass of a vessel for that particular condition.

Engineering Officers: These seafarers who work aboard ships also possess Certificates of Competency as Marine Engineers. Their role is to monitor the functioning and to maintain all the ship's machinery; the equipment can be either mechanical or electrical.

Fire: Includes ships lost as a result of fire or/and explosion where it is the first event reported – it therefore follows that casualties including fires or/and explosions after collisions, strandings, etc would be categorised under 'collision', 'stranding'.

Flag of Convenience (FOC) are the national flags of those states with which shipowners register their vessels. These countries are used in order to avoid:

- fiscal obligations and
- working conditions and
- terms of employment

that would have been applicable if their ships were registered in their own countries (Doganis & Metaxas, 1970).

Flag State: The ship as a danger to life and the environment is the responsibility of two regulatory entities. The first is the state in which a ship is registered, this is known as the *Flag State*.

Flag State Control: Once a convention is ratified at the International Maritime Organisation (IMO), each ratifying state embodies the clauses contained therein into its own law. The state then sets up a system of enforcement for vessels registered with it. This is known as *Flag State Control*.

Freight: It is the amount of money a shipowner charges to carry goods from one port to another. Freight may be charged per volume or weight depending on the density of the cargo. Low density cargoes are charged per volume and high density cargoes are charged per weight.

Gross Tons: It is the total internal volume of all the ship's cargo carrying capacity expressed in cubic metres.

Grounding: Ships lost as a result of striking the sea bottom.

Injury: Damage to any person whilst working aboard ship.

Innocent Passage: Passage is considered innocent so long as it is not prejudicial to the peace, good order or security of the coastal state as per the *United Nations Convention on the Law of the Sea*, 1982, Art 19.1. The right of innocent passage is accorded to all ships.

Integrated Rating: Integrated Ratings are persons working aboard ship possessing certificates of proficiency. These persons are trained to carry out duties in the engine room as well on deck and can work in either area. They are also known as *General-purpose Ratings*.

International Maritime Organisation (IMO): This *United Nations (UN)* agency is a round-table where members meet to agree on common international standards in the form of conventions.

Lightship displacement or weight: It is the weight of a vessel either in Long tons or metric tonnes. This only takes into account the weight of the materials used in the construction of the vessel.

*Loaded displacement: T*he amount of water displaced by a vessel when it is floating at its summer load-line mark. The loaded displacement could also be taken as the mass of the vessel.

Other: In a casualty incident any damage that occurs to a vessel that cannot be categorised in any of other categories described for the purpose, are placed in the 'other' category, i.e., damage done to a vessel as a result of an act of war or a hostile act, and hull and machinery damage or failure would also be listed in this category.

Port State Control: The IMO has provisions allowing a flag state to inspect a vessel registered in another state, to determine whether or not that ship is complying with its International obligations. This system is known as *Port State Control*.

Prevention of Pollution from ships (*MARPOL) convention:* This is an IMO convention designed to regulate against the pollution of the oceans and waterways by ships sailing at sea.

Protection and Indemnity (P&I) Club: It is a mutual insurance association or non-profit making organisation, which is usually registered as an unlimited company under the Companies Act. Members contribute to a pool of money according to the tonnage that they have entered with the association and a rating factor. Claims made by the owners are paid from this central pool and if at the end of a policy year money is left in the pool it is returned to members. Alternatively, additional calls for contributions are made should the level of claims exceed the amount in the pool (Gaskell, Debattista & Swatton, 1987).

Ratings: Ratings are persons working aboard ship possessing certificates of proficiency. They are trained to do tasks that require a lower skill level and are supervised by officers or engineers. Ratings can work either in the engine room or on deck, depending on the area for which they have received training.

Scavenge space: A scavenge space is the space between the bottom of the piston and the bottom of the crank case space.

Safety of Life at Sea (*SOLAS) convention:* This is an IMO convention that specifies the minimum standards that are required for the construction of merchant vessels, their firefighting, life saving and radio communication equipment. The convention also contains regulations that are designed to contribute to the safe carriage of cargoes, the safe management of ships and lists the certificates that each ship must carry.

Signatory State: A signatory state is a country that is signatory to the SOLAS, STCW or MARPOL conventions.

Standards of Training and Certification of Watchkeepers (*STCW) convention:* This is an IMO convention that specifies the minimum training that each person working aboard ship must receive. It also outlines the tasks that all watch-keepers must perform in various situations.

Stranding: When a ship touches the sea bottom, sandbank or seashore, etc. This category also includes the entanglement of a vessel with submerged wrecks.

Underway: A vessel is considered to be *underway* when it is not at anchor or made fast to the shore or aground.

Chapter. 1

Introduction

1.1 Introduction to the study

The maritime industry is one of the oldest professions, it has over the millennia developed into a global and highly complex entity. The principal focus of the industry, however, remains on the ships that transport cargo from one port to another. These ships fly the flags of many nations and are crewed by seafarers of different nationalities.

This chapter seeks to examine the context, background and shipboard climate within which these ships operate. It also describes the principal economic and competitive functions of the industry, both within the seafaring as well as the non-seafaring sector. It describes some of the pressures being exerted by the financial environment on the industry, which would help to explain why some shipping companies may operate in the manner they do.

Another pressure exerted on shipowners is by the Regulatory Sector of the Maritime Industry. This sector comprises the Safety Authorities of each maritime nation, the International Maritime Organisation (IMO) and Classification Societies. The role that each have with respect to the maritime industry and the impact their actions have on seafarers are discussed in later sections.

The major aim of this study is to describe the organisational culture and climate aboard ships. It also aims to explore if there are any possible links between the organisational culture and climate of a ship and the occurrence of accidents.

The research questions identified from this broad overview are briefly presented in section 1.1.4 at the end of the chapter. The importance of this study with respect to the maritime industry is outlined in section 1.1.5.

The limitations that became apparent during the conduct of the study and in discussions with concerned parties are described in section 1.1.6.

1.1.1 Discussion of the overarching issues that have an influence on this study

1.1.1.1 The hierarchical and functional composition of a ship's crew

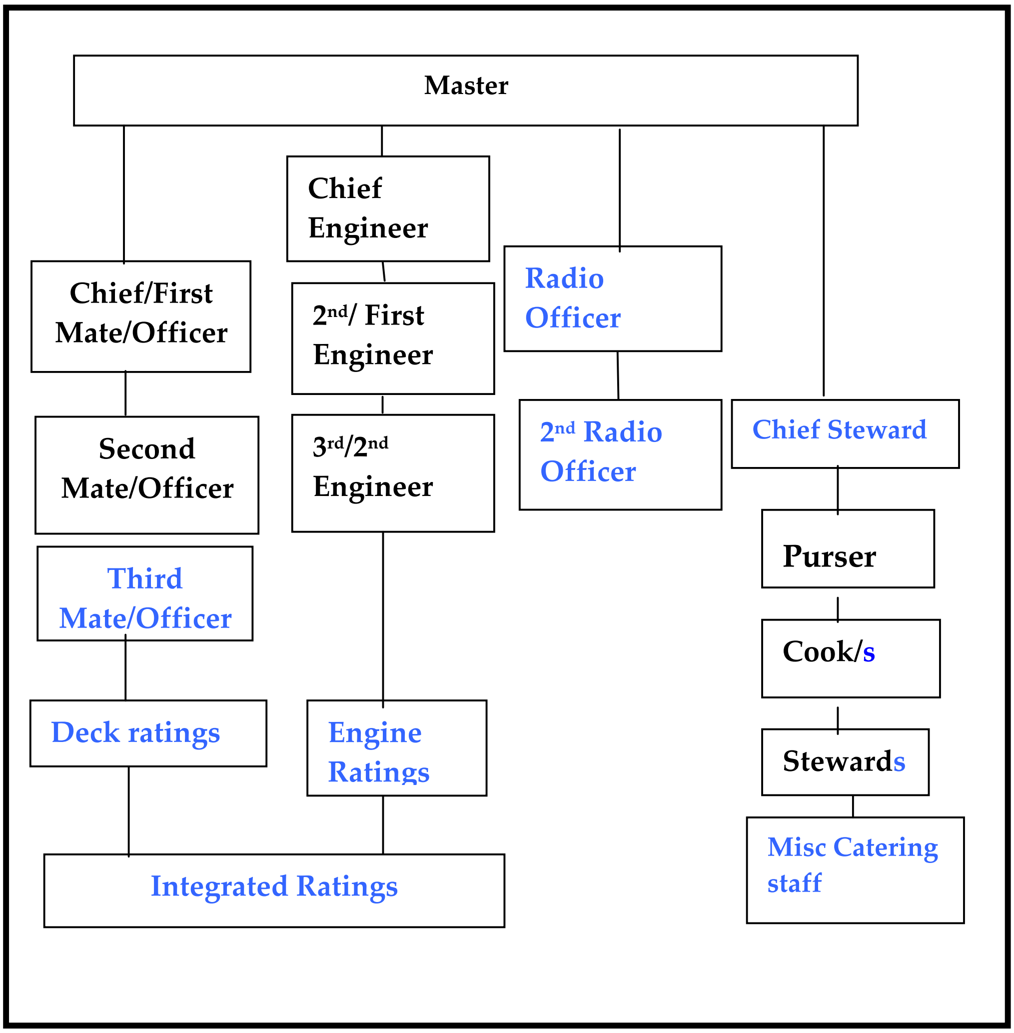
Prior to discussing the effect that various environments have on seafarers it is necessary to review seafarer routines and operations on board a ship. This will enable the reader to contextualise events and the environment in which they occur.

Historically ships have had three categories of seafarers: The Officers or Mates who supervised work aboard, the Sailors or Ratings, who assisted the Mates in their tasks, and a very small group of catering staff. There also possibly may have been a ship's Doctor, this depended on the type of voyage that a vessel was making. The Officers or Mates were trained to perform navigational as well as cargo handling tasks. The Ratings, however, were more rudimentarily trained in ordinary seafaring tasks. These tasks could have been the furling and unfurling of sails, hoisting of the anchor, the maintenance of sails and many other similar tasks. Today Ratings are used for steering a ship, performing lookout functions as well as other routine ship-maintenance tasks (see Appendix 1 for a detailed description). The Mates and Ratings described here are categorised as the 'Deck Department'.

With the introduction of machinery-propelled ships, the organisational structure of a ship had to be changed to accommodate this advance in technology. A new department called the Engineering Department was formed to run and maintain this machinery. This Department consisted of trained Engineers known simply as Engineers or Engineering Officers and the relatively less skilled persons assisting them, known as Engine-room Ratings. The Engineers and ratings that assisted them are categorised as the 'Engine Department'. The Heads of Department (HOD) on a ship therefore are the Master, who is in command of the ship; the Chief Engineer who is the HOD for the Engineering department, and the Chief Officer who is HOD of the Deck Department.

Table 1 depicts one of the most common organisational structures that may be found on a conventional merchant ship. The positions, or items in black, signify the positions that are most likely to be found on such a ship.

Table 1. Hierarchical structure of a conventional merchant ship.



(Adapted from Matsubara, 1987)

The positions shown in blue signify specialised tasks that are performed only on certain types of ships, or have been eliminated by a shipping company for various reasons. For instance the position of a Purser is now only likely to be found on passenger vessels or ferries. This position is no longer common-place on cargo ships, in many instances the Master performs the task of Purser as well as Chief Steward. In the case of Ratings, the categories of Deck Rating and Engine Rating were abolished after Ratings began to be trained to perform tasks for both departments and were re-categorised as 'Integrated Ratings' (IR) (see Appendix 1).

Alterations to the organisational structure of a ship were often the result of assigning multiple tasks to seafarers, the catalyst being changing technology (Cahill, 1997). The main objective for this multi-tasking was to gain operational efficiencies, more especially cost efficiencies, on board a ship. The factors that promoted this focus on cost cutting by a shipowner are discussed in the following sections.

A direct consequence of altering the organisational structure of the ship and the award of multiple tasks to seafarers, was the alteration of their work routines in ways that increased the likelihood of them experiencing fatigue. Later sections of this study will show that fatigue can have an important bearing on the safety climate of a ship.

The observable organisational structure of a ship is a linear hierarchical one (see Table 1). The lines of communication are also linear and travel from a Head of Department (HOD) downwards. An external observer would assume that such a system strongly resembled a formalistic type of organisation. Members of a formalistic organisation were likely to display behavioural characteristics that would typify such an organisation. One of the aims of this study is to determine whether seafarer behaviour impacts on the safety culture of a ship.

1.1.1.2 Dominant influences on the Maritime Industry

Two issues appear to have a major influence on the majority of seafarers. They are the Regulatory environment and the economic environment within which all ships operate. The next two sections therefore are devoted to discussing briefly these issues and the effect that they have on seafarer behaviour.

1.1.1.3 The Maritime Industry's Regulatory bodies

Regulatory bodies are relatively new to the maritime industry as they emerged in the 19th century. One of the first regulatory instruments applied to ships was the Plimsoll line named after Samuel Plimsoll who championed its passage through the English Parliament in 1875 (Peters, 1975). The Plimsoll line, also known as a loadline, was placed on the sides of all ships to signify the maximum extent to which a ship may be submerged. Harbour authorities were then given the task of policing the regulation by not allowing a vessel to sail out of port if the loadline was submerged. Such a measure was thought necessary, as there was a growing awareness amongst the general community that shipowners were deliberately flouting safety norms. Goss (1991) contended that relatively many shipping companies flouted safety regulations in the name of commercial expediency. Other studies (Beetham, 1983; Card, 1995; Cahill, 1997), however, do not make such a direct allegation but allude to it more indirectly. The Select Committee (1992) and Reason (1990) partly support Goss's (1991) statement, as they noted that many shipping companies had developed a `pathological' attitude toward safety by doing the minimum amount required by regulations to keep their ships plying. Both authors, however, did not venture to provide a reason for this attitude. Such an attitude toward safety illustrates to seafarers the bias that many shipowners may have when a situation placed commercial expediency at odds with safety. When placed in similar situations seafarers will look towards their shipowner to determine the action they should take. In light of the above it is likely that they will also choose commercial expediency over safety (Goss, 1991). The negative impact that this will have on safety culture of a ship is self-evident.

Over time the maritime industry evolved from local or national bodies to multi-national organisations. The passage of time also saw the industry develop a global framework where ships from one nation picked up cargoes from another and delivered it to a third country. From that point on national shipping problems started to become global ones. To resolve these issues an International forum, the International Maritime Organisation (IMO), was created. This forum developed many conventions that all internationally plying ships need to comply with; the conventions are principally SOLAS and MARPOL. Most IMO member countries accepted these two conventions by taking them back to their own countries and legislated the convention's clauses into law. The task of policing these laws is entrusted to the Maritime Safety Authority of each signatory country.

One of the methods devised by the Safety Authorities to ensure that shipowners complied with the regulations was to create a Registry in each of the country's ports. This Registry recorded the details of all the ships that had declared it as its 'Home Port' (Kasoulides, 1993). In addition, Maritime Safety Authorities were tasked with ensuring that seafarers who operated these ships had appropriate qualifications; and that a ship complied with the international safety conventions of which the host country was signatory.

Compliance with these safety conventions were also applied to non-flag state ships in what is known as *Flag State Control*. Flag State control consists of surveys, certifications and inspections by flag state surveyors and inspectors. The task can however be performed by a Classification Society on the state's behalf. The above shows that the areas governed by Safety Authorities and Classification Societies can and often do overlap. Later sections will illustrate the deficiencies of each institution and the impact that they have on the safety culture of a ship.

Classification Societies were originally established to ensure that the ships registered under a particular flag maintained their class status. Maintaining a ship according to its class influenced the amount of insurance premium a shipping company paid. Currently there are many Classification Societies, which are private companies, who compete with each other for a shipowner's business (IMCA, 2003). A later section will show why this system appears to impact negatively on the safety culture of a ship.

1.1.1.4 An overview of the economics of the maritime industry

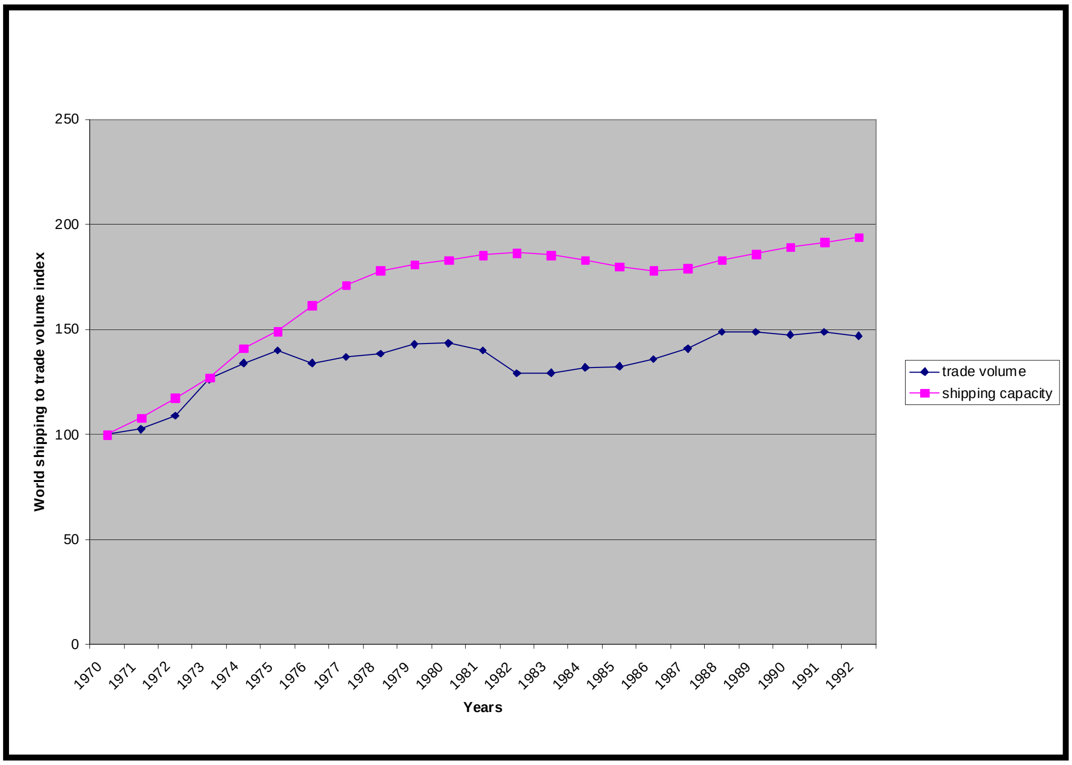
Many actions taken by shipowners seem increasingly to be driven by shipping economics, therefore the following section describes in some detail the pressures exerted by the international shipping economic environment.

A major portion of a shipping company's income is earned from the freight earned by its ships. The basic determination of how much freight a ship can charge depends on the availability of ships, otherwise known as tonnage, vis-à-vis the availability of cargo. In addition there are other variables that may influence the amount of freight that may be charged. These variables are the risks associated with the transport of cargo, such as weather, war, or union activity at the ports in which the vessel docks. Environmental factors may also have an impact, such as, the occurrence of flood or drought, and the effect of political activity, such as, the imposition of embargoes, blockades and political disruptions, as has recently occurred in Liberia.

Other factors that influence the amount of freight that may be charged are the sentiment of the market, such as, the state of the world economy during which the transport is to occur. A further consideration is known as backhaul, or the ability of a ship to get another load of cargo in the country of destination, i.e., if a ship is easily able to pick up a cargo in the country of destination the freight that the ship charges can be lowered. In the main, however, the supply versus demand of shipping services is the dominant influence that determines freight rates.

Table 2 depicts the trend of availability of tonnage to the availability of cargoes from 1970 to 1992. The demand for shipping in the 1970's closely matched the availability of tonnage. After the international oil crisis of 1973, however, market conditions changed creating an over-supply of ships. This surplus tonnage resulted in downward pressure being exerted on freight rates and therefore on the earning capacity of shipping companies (Alderton, 1995). As shipowners do not have full control over how much freight they can charge they look at other avenues to maximise profits. One of these avenues is by cutting operational costs.

Table 2. Comparison of ship capacity and volume of sea trade.



(Adapted from Alderton, 1995.)

The market conditions described above bear the hallmarks of a depressed market. If the freight rates are so low as to be marginally uneconomical it places a shipowner in the precarious position of deciding whether to lay-up a ship or keep it plying, albeit on lower earnings. The decision to lay up a ship, or stop it from plying, can be considered when the freight does not cover the operating expenses of a ship. This decision is made all the more difficult because the ship is a large capital expense and the interest payable to fund this capital cost is large. The approximate cost for a 1000 unit container vessel or an equivalent solid bulk carrier would be about US $25 – 30 million. The size of the described ship is relatively modest by today's standards. This financial fact would make shipowners typically loath to lay them up as they need to keep the ships working to repay the loan obligations incurred for their purchase. A shipowner is therefore placed in the somewhat invidious position of having to accept whatever price the market sets in order to mitigate losses. Thus the pressure to keep a vessel plying to at least earn some revenue is significant.

In addition Table 2 showed that these depressed market conditions have persisted for a long time. One of the main foci of shipowners in such market conditions are the costs associated with the operation of the company. Alderton (1995) describes these costs in a now commonly used three-category system. The first category comprises costs related to the administration of a ship and the depreciation associated with its purchase. The second, consists of costs incurred for stores, repairs, salaries and on-costs, and the insurance required for the ship. The final category consists of costs associated with moving a vessel from one port to another, cargo handling and other port dues. A reduction in incurred expenditure in any of these three categories would reflect in better operating revenues for the company.

The issue however is not as simple as it seems, as the shipowner does not have discretion on how the costs that are incurred in certain categories may be expended. For example, a shipowner is bound to pay the interest on any loan taken out to purchase a ship. This interest rate is either fixed and stated in a contract, or is variable and is therefore determined by the monetary policies of the country in which the loan was taken. Another example, are the fuel costs associated with moving a ship from port to port, here the International market determines the price of oil. When a ship has to be re-fuelled the shipowner has to pay the current rate for the fuel in the country where the ship has been re-fuelled. Grewal (1997) in his study stated that in total non-discretionary expenses accounted for approximately ninety percent of the operating expenditure of a ship.

The other ten percent that could be labelled as 'discretionary' costs include administration costs, crewing costs and profits. A shipowner, like any other business-person, will seek to reduce any perceived or unnecessary costs in order to maximise profits.

Among the other significant pressures that a traditional shipowner must contend with in the current environment is the emergence of third world shipping companies. These companies have relatively lower operating costs than would, say, European shipping companies. They are therefore able to carry cargoes at lower freight rates than their European counterparts. Thus, besides the operation of normal market forces that keep freight rates down, competition from third world fleets further add to this downward pressure. All of these competing pressures place a modern shipowner in a far more complex and demanding environment than would have occurred in the past. It is understandable therefore that the search for economic efficiencies became more wide-ranging and important.

There are many companies who, as a result of the above, implemented severe cost cutting regimes. It often appeared that these steps to reduce costs took place without consideration being given to the impact they may have on the operational efficiency of a ship. To exacerbate this situation shipowners often did not consult with the concerned seafarers when they contemplated these strategies.

In such an environment Goss (1991), Card (1995) and the Select Committee on Science and Technology (1992) argued, safety related expenditure, such as money for ship maintenance or training, were viewed more as a cost rather than as an investment. Consequently casualties were something that needed to be insured against rather than avoided. For example the decision to reduce the crew's wage bill by hiring third world crews resulted in handing over the crewing function to an agency that usually operated in a third world country. The crews that arrived on board faced problems with which they were unfamiliar; such situations may increase the likelihood of an accident occurring (Reason, 1990). Thus while the economic rationale was clear it was the unintended consequences of these actions that may have negatively impacted on the safety culture of a ship. These impacts are detailed in the following section.

1.1.1.5 The impact of the prevailing economic climate on seafarers

One immediate outcome of the financial constraints on a shipowner was their focus on the ship's crew wage bill. This focus resulted in a number of actions that occurred concurrently. The first was the reduction of crew numbers by outsourcing selected routine work to lower cost organisations. These tasks were usually maintenance tasks performed by a Rating while the ship was at sea or was in a non-critical phase of its voyage. The tasks included, for example, the overhaul of machinery, the washing of the crew's linen or the de-rusting of the ship's structural plates. The described lower cost organisations performed these tasks when the ship was in port. As a result of these outsourcing activities shipowners reduced the number of seafarers on board by a number they perceived was commensurate with the overall reduction in the workload of the ship. Cahill (1997) observed that shipowners often overestimated this reduction and as a result took off more crewmembers than the workload reduction justified. This overestimation may have resulted in an increased workload for seafarers on board. In addition, in some cases these outsourcing of tasks increased a seafarer's workload (Cahill, 1997). For example, where the overhaul of machinery had been transferred to a shore organisation, in many cases after the ship had sailed out parts of the overhaul had to be redone, as they had not been done to the ship staff's satisfaction (Beetham, 1983). The effect of this could be two-fold, the first would be to increase the level of stress experienced by the affected seafarer and the second may be to lower that person's motivation to work, both factors are not conducive to the improvement of the ship's safety culture.

Another consequence of this reduction in crewing levels was that it compelled crewmembers to change their style of work to cope with the increased workload (Cahill, 1997). Such a situation could be harmful in a number of ways, if an emergency occurred. In the first instance there may be insufficient people on the ship to respond to the emergency, especially if a ship is in port and some crewmembers had gone ashore. This situation would be exacerbated if the emergency destroyed the installed automated technology that monitored the functioning of the ship's machinery, such as utilities like the fire pumps. When this happened the monitored machinery would automatically shut down and would have to be restarted manually. A person would then have to be deployed to monitor this machinery. As many seafarers already perform multiple tasks this reduction of resources would place an additional load on the remaining seafarers aboard. If the emergency such as a fire is not brought under control in a short period of time, typically ten to twenty minutes, it becomes a major event and the damage that a ship sustains as a result is much higher (Tavistock Institute of Human Relations, 1988)

Another result of a shipowners' focus on the crew's wage bill was the replacement of traditional crews with Third World crews (Beetham, 1983; Goss,1991; Cahill, 1997). The rise in a traditional seafarer's wages occurred at the same time as the rise in the cost of living in many of the traditional maritime nations. Shipowners paid these increased wages until they became aware of the cost savings available by hiring Third World crews. The disparity in wages between Ratings of the traditional maritime nations such as Europe and the developing Third World nations is large. This disparity offered the shipowner considerable savings on the wage bill of a ship and proved a popular alternative to using Ratings from the ship's original homeport. The inevitable movement toward the hiring of cheaper crews was made possible by crewing agencies. The advent of modern communication media allows a crewing agency from one country to provide this service to a shipping company in another country very efficiently. This trend also has manifested itself in the hiring of Officers and Engineers from other countries. The laws of many countries require shipping companies to hire crews of the same nationality as the ship's Port of Registry. To circumvent these laws a shipowner often transfers the registry of a ship to a Flag of Convenience (FOC) country.

A shipping company coordinates all the above activities through its crewing department. The head of the crewing department generally is either a Marine Superintendent or Marine Manager. The Marine Superintendent/Manager tends to have the most interaction with the Officers and Engineers of a ship. The management of a shipping company also channels most of their communications to ships through the Marine Manager/Superintendent. When seafarers think of the management of a company it is often on this person that they focus their attention.

An important consequence of hiring Third World seafarers is the physical separation that occurs between the Marine Manager of a shipping company and the seafarers. In this system seafarers are flown directly to the ship when they join and directly home at the end of the contract period. They are thus unlikely to personally meet the Marine Manager or any other person involved in the crewing of the ship. This lack of interaction may result in perceptual differences between the crew and the management especially in areas of operational procedures and safety norms. Management will expect the Ratings and Officers to perform in the same manner as did ship's crews in the past. This however tends not to occur as the crew is from a different country and may have been trained differently and, therefore, may have different work practices and norms. This divergence of operating practices can cause misunderstandings between the ship's management and the crew, with the crew bearing the brunt of any consequences that such a misunderstanding may bring about. As a result the Goss (1991) stated that the ship's crew reported that they had no confidence in the management's understanding of ships or their problems. These seafarers, however, did not complain even when safety is at stake, for fear of being dismissed. The stress levels on ships operated by such companies are high and staff-morale is low (Goss, 1991). Conditions such as these are not conducive to safety nor do they promote a culture focussed on safety.

The above trends of cost cutting, crew reduction and crew transplantation have had a negative impact not only on the seafarers involved, but also on the seafarer community in general. A seafarer's traditional loyalty towards a shipowner has been one of the first casualties, as they no longer view a shipping company as a long-term employment prospect. Such a change in perception may have an indirect negative effect on the rate of occurrence of accidents.

1.1.1.6 Weaknesses of the current system of operations in the maritime industry

The expertise of Classification Societies lies mainly in the field of mechanical and structural engineering. This expertise is reflected in the compliance procedures that they design for ships (Goss, 1991). As an example, a Classification Society always checked to see if the equipment installed on board met prescribed standards; they did not check, however, to see whether the crew could read the accompanying operating instructions and therefore properly operate the equipment. In addition, Classification Societies were diligent in ascertaining whether sufficient seafarers were on board to operate a ship safely. However they did not check to determine whether sufficient crewmembers had a common language to enable them to, either, work together efficiently, or cope with an emergency, should one occur. It is clear from the above that the focus of a Classification Society was solely on the compliance of the ship as a system and not on its seafarers or its operating environment. There are occasions where the operating environment makes it difficult for the ship's crew to achieve the desired compliance standards expected by a Classification Society (Goss, 1991; Select Committee on Science and Technology,1992).

The governing boards of Classification Societies typically do not have as members, seafarers or people who utilise the services of ships. Rather Shipowners, Shipbuilders and Insurers dominate their boards. This domination by one section of the shipping industry may tend to bias the focus of Classification Societies toward the interests of its constituent members, namely ship operators. Previous sections have outlined the context within which ship operators/owners function and the issues on which they may focus as a result. It is these issues that were likely to influence the persons who framed the compliance procedures for ships.

In addition, currently no feedback system exists to address issues that seafarers may have when such procedures have undesirable outcomes. The absence of such a mechanism could result in a focus that only took into account the shipowners' views and thus ships and their machinery would be built and maintained in accordance with procedures that were biased toward economy of operations rather than safety. As an example, all Classification Society surveys are carried out when a ship is in port and in the busiest part of its operational cycle, rather than allocated to specific less busy periods during which these tasks may be accomplished. When a ship is in port the ship's officers have to supervise the loading/discharging of the cargo, while the Engineers have to perform operational maintenance on machinery, some of which can only be done whilst a ship is in port. The additional workload for the Officers and Engineers would be to prepare the relevant sections of the ship's structure for survey by a Classification Society surveyor. Thus Classification Societies may be contributing inadvertently to an adverse working climate within the maritime industry, where the focus is on economy of ship operations and compliance with procedures rather than the implementation of effective procedures and safety. This may be one factor, among many others, that indirectly impact adversely on ship safety.

There are other factors that strengthen the bond between shipowners and Classification Societies. Classification Societies are commercial entities that have to compete with one another for business in the maritime market - place. This situation has advantages when a market is healthy; in a depressed market, however, many Classification Societies may be tempted to minimise the demands of their rules, skimp on surveys, class ships that are in a dubious condition or even ships that break the rules altogether (Goss, 1991). If this occurs, the activities of Classification Societies have a direct negative impact on the ship safety culture of the industry.

If a shipowner is dissatisfied with one Classification Society, the shipping company is free to *class out*, or take their custom to other Societies who are willing cater to their demands. This strengthens the dominance of Ship operators over Classification Societies and could tend to make Classification Societies more amenable to pursuing a shipowner's agenda.

From the above material it would appear that many of the regulatory functions of the shipping sector have devolved to organisations that are dominated by shipping operators. These organisations do not have any arrangements that seek an input from seafarers on the effectiveness of their procedures. The lack of regular and systematic dialogue between both groups may foster a climate of separateness between seafarers and ship operators. In addition, the focus on compliance and enforcement by these organisations coupled with the negative reward system practised by the industry may make a seafarer defensive toward people working for such an organisation.

Not only are shipowners able to switch classification societies but they could also register their vessels anywhere in the world regardless of where the company is physically based or the country in which it is incorporated. In the past three decades much of the shipping beneficially owned by shipping companies of the developed world have flagged out to '*Flag of Convenience' countries* (FOC). These FOC countries usually do not own, operate or manage the ships registered in their ports. Some of these states have little or no maritime tradition. One of the principal reasons for a shipowner to flag out is to gain financial advantage by paying lower taxes and shipping levies in the FOC state (Dogannis & Metaxas, 1970; Goss, 1991; Card, 1995).

Another reason to flag out, according to the Select Committee (1992), was to evade the crewing requirements of a flag state, which also could be termed as gaining a financial advantage. Third World crews who could be less well trained are replacing the crews of traditionally dominant maritime nations. There are in many cases, therefore, a sense of dislocation between seafarers and the managing entity of a ship, which may affect the communications between the two. The disruption of communications may occur as a result of perceptual differences on issues of safety as well as on operational procedures. It is the combination of a dysfunctional communication system and these differing cultural perceptions that may negatively impact on the safety of a ship (Tavistock Institute of Human Relations, 1988). The use of Third World crews may put further barriers between the shipowner/operator and seafarers, and it also may serve to strengthen the feeling of mutual separateness between the two.

In an effort to introduce common training standards worldwide the IMO developed The Standards of Training, Certification and Watch-keeping Convention of 1978 (STCW, 1978). Historically, however, these conventions prescribed low standards as they had to reflect an agreed level by all signatory countries. This also proved to be the case with the STCW convention as some signatory countries found the standards so low that they issued minimum training standards that were higher than those prescribed by the Convention. This accentuated the differences in the training provided by Third World countries and those of the more advanced maritime nations. To further add complexity to this issue, some flag states issue Certificates of Competency based on examinations that do not meet the minimum standards prescribed by the STCW convention.

Other states, particularly the FOCs, issue an equivalent Certificate of Competency to seafarers who provide evidence of having a Certificate of Competency issued by another flag state authority. Thus rather than unifying the global training and certification system the introduction of the STCW (1978) convention resulted in a more diverse training system for seafarers. If the seafarers who work aboard come from and are trained in different countries it is highly likely the standards to which they are trained will be different. Having people with differing capabilities increases the workload on seafarers who have had better training. It thus appears, to these seafarers, that they were being penalised for having been better trained, which could not only impact on their morale but also on the overall operational efficiency of the vessel.

In addition to variable training standards the Select Committee (1992) called into question the appropriateness of the education being received by seafarers. One of its conclusions was that although the training and certification of seafarers could be very thorough it often bore little relation to the operations that seafarers might be required to perform when working aboard a ship. For instance, officers who were assigned to work on a petroleum tanker had to do short courses known as a 'Tanker Familiarisation Course' and a 'Tanker Safety Course' before they could go aboard these vessels. These courses dealt with a general description of the trade, some definitions and necessary safety issues appropriate for such ships. While the courses describe operations conducted aboard these vessels they contained very little that prepared seafarers to conduct oil transfer operations safely and efficiently. The Certificate of Competency course that an officer is required to pass also has no subject that deals specifically with Oil Tanker operations but instead has a generalised cargo operations module.

On the other hand, the view of a shipowner or operator is that if a seafarer possesses a Certificate of Competency along with all the appropriate short course certificates this person is fully equipped to deal with all the operational problems likely to be encountered on board ship. However, as explained above this is not likely to be the case, especially if the person concerned has just obtained a Certificate of Competency prior to joining ship. When a seafarer is hired through a crewing agency from another country, the shipowner is making an even larger assumption about the seafarer's ability based on the documentary evidence produced by the person concerned i.e. as the training standards in the seafarer's country could be different from those of the country in which the Shipping Company's Headquarters was located. If an accident did occur, and the relevant seafarer was the person in charge of the operation, the shipowner would assume that this person was incompetent and, in most cases, make arrangements for a replacement Officer or Engineer to be sent to the ship. A series of small lapses on a seafarer's part, which may or may not result in an accident, could have the same consequences. These events would transpire even if cause of the accident may not necessarily have been a lack of ability on the part of the concerned seafarer, but due to a gap in the seafarer's training or the seafarer's inexperience. It is likely that this negative reward system, which may be practised by the Maritime Industry, would encourage secretive and defensive behaviour rather than encourage open and frank disclosures of mistakes by seafarers.

To compound the problem of inappropriate training the Select Committee (1992) found that although ships' officers were required to have Certificates of Competency, the shore based operator of these ships was not required to have any qualification. A person untrained in the management of a company and its human resources was likely to be severely under-equipped to understand the consequences of the extensive cost cutting frequently practiced by the maritime industry. Such a person may fail also to assess the consequences of these practices on the safety of a ship, its impact on a ship's crew's morale and ultimately on the company's profits. Historically when such a person (e.g., a Marine Manager) was faced with the problem of dealing with a serious accident aboard ship, the first action this person took was to remove the seafarer, to whom the cause of the accident could be directly attributed, from the ship. These actions highlight the need for training Human Relations personnel in a shipping company in techniques designed to elicit positive behavioural responses from seafarers, rather than persist with the current system, which encouraged defensive behaviour.

The above factors highlight how events within the industry may impact on the way seafarers communicate and on their behaviour patterns. It was clear from the above that seafarers may act defensively when interacting with personnel from the shipping company.

Regulations also impact on other industries which can, in turn impact, on seafarer operations. For example the safety regulator's approach to ship design was very prescriptive as well as reactive and was more suited to cope with a slow evolution of ship design. The development of new ship designs in modern times is currently very rapid, with the development of a myriad of new as well as different ship types and sizes. The development of these new designs in many cases requires special rules not only for their construction but also for their operation. The traditional approach taken by the industry was described as being entirely inadequate to cope with such demands (Select Committee, 1992). If the Regulatory Sector has not kept up with changing technology seafarers, on the other hand, were placed aboard these craft and were expected to handle them safely. If they were inadequately trained for ship types that regulators knew about, it would follow they would be even less equipped to properly handle a completely new ship type. Considering the shipowner's treatment of seafarers involved in accidents it appeared that seafarers have to bear the brunt of any negative events that may be associated with the introduction of a new ship type (Select Committee, 1992).

A case in point is the development of high-speed multi-hull ships. The high-speed code that was developed to deal with these craft was framed only after there were many such craft already plying on the seas for many years.

Additionally, it is worth noting the current trend of shipbuilders to use high tensile steel in ship construction. The characteristics of this metal require a level of inspection on par with nuclear- and aircraft structures. It is a regime that is far more rigorous than what is being currently employed by the industry, as these structures are much thinner than traditional steel but corrode at the same rate. Consequently, if the same maintenance regime was used on these metal structures they can be expected to fracture much earlier than would normal steel (Palermo, 1996). The result could be that seafarers have to maintain them with a higher level of diligence, but without any compensatory increase in the number of crew members on board the ship. It has been hypothesised that the mysterious sinking of many bulk carriers worldwide occurred as a result of similar fatal structural fractures (Palermo, 1996).

The preceding paragraphs have highlighted the effect that the direct and indirect operations of external bodies may have had on the safety of a ship. There is another factor that impacts on ship safety and this is the structure and method of operations of a shipping company. A department, usually located at the shipping company's head office manages each ship. This poses a unique problem whereby the manager is physically separated from the ship being managed. Such a situation appears to serve as an insulator between the two. Thus when an accident occurred on board a ship, the ship-manager appeared unable to link the activities of the head office as a probable cause for the incident. It therefore appears that a seafarers attitude toward safety was that is was not of primary importance and were secretive toward their employers.

This situation is exacerbated if one adds in the climate of secrecy and blame avoidance described as being practised by many shipping companies (Card, 1995). Some shipping companies appear to take this blame avoidance to extreme lengths. Accident investigators in the aftermath of many accidents have often found it extremely difficult to determine, for example, who really was the ship's operator. It was in recognition of this issue that the IMO created the International Safety Management (ISM) code in 1994. The code was formally adopted and included as Chapter IX of the SOLAS convention thereby making its implementation mandatory by all signatory states from 1998. One of the main aims of the code was to link every ship to a ship operator. The ISM code for the first time made ship-managers responsible for their actions if these actions were found to be one of the causes of a maritime accident.

The consequences of a poor ship safety culture show up clearly in the Tables of average loss ratios compiled by Lloyd's Register of Shipping for the years 1997, 1998 and 1999. These Tables list the casualty statistics of 44 flag states in terms of the number of ships affected, their gross tonnages and the age of the ships (Appendix 2). It will be noticed that FOC and Third World country fleets dominate the top ten affected flag states (Lloyds Register of Shipping, 1997; Lloyds Register of Shipping, 1998; Lloyds Register of Shipping, 1999). Similar statistics were revealed in the deficiency reports filed by Port State control inspectors and submitted to the IMO as part of the Port State control process. Half the ships reported for deficiencies were registered in FOC states (Select Committee, 1992). These data would indicate that the safety cultures on ships flying FOC and third world country flags were amongst the poorest in the maritime industry.

1.1.2 Significance of the problem

1.1.2.1 Importance of shipping to the world

Twentieth century transport began with the horse and carriage and has now extended to spacecraft with the space shuttle as probably the most advanced cargo carrier in the world today. Advances in transportation technology revolutionised the conduct of human affairs and was a prime mover assisting much of the current world's economic as well as social transformation. This new mobility has blurred national boundaries allowing much of humanity to achieve unimagined levels of production and income.

Gross world product increased about fourfold between 1950 and 1983-5. This increase was made possible as a result of a seven-fold increase in the international seaborne trade and a sixty-fold increase in air travel (Owen, 1987). Table 3 presents the changes in world population, gross world product and the quantum of goods carried by each transport mode between the years 1950 and 1983-85. The table illustrates the expansion that occurred within each segment of the transport sector and highlights the major role that shipping played in this generation of wealth. The Table was not designed to make comparisons between each mode of transport.

Table 3. Selected World Activity Growth and Transportation.

Activity	***Years***	
	1950	***1983-85***
Population (Billions)	2.5	5.0
Gross World Product (Trillions of 1980 US$)	2.5	10.2
Merchant Fleets (millions of gross tons)	93.0	425.0
International seaborne shipping (millions of tonnes loaded)	550.0	3415.0
Rail Freight (billions of ton-miles)	1.2	4.3
Motor vehicles (millions)	70.0	473.0
Air travel (billions of passenger miles)	9.0	651.5
Telephones (millions)	90.0	508.0

(Owen, 1987)

Harris & Simmonds (1979) however did make such comparisons and stated that ships carried almost two-thirds (62 percent) of the goods traded by western countries in 1979. A comparison of the above figures and those produced by the United Nation in 1991 showed an unchanged situation. The United Nations' (1991) statistical trade data placed the total value of world trade carried by all forms of transport at US$3,526,603 million and the shipborne trade figures of the developed economies for the same period at US$2,582,008 million. Thus ships carried 73 percent of the total goods traded in that year.

In 1991 the world's fleet numbered 80,030 ships with a cargo carrying capacity of 407 million gross tons (Lloyd's Register of Shipping, 1991a). Applying these tonnages to the values provided by the United Nations, it could be shown that each gross ton of shipping space in 1991 earned an average of US$6344 in revenue. This figure allows an estimate of the loss of revenue to be made if a ship was destroyed. With an industry so large, small gains in safety can translate into the saving of large sums of money. This is readily demonstrated in the next section.

1.1.2.2 The cost of having an unsafe maritime culture

In 1991, 155 cargo carrying ships totalling 1.46 million gross tons (Lloyd's Register of Shipping, 1991) were completely destroyed as a result of accidents. Using the figures from the previous section, this represents a loss in potential revenue of about US$9,262 million. These figures represent only the loss of revenue to the shipowner, they do not account for the actual loss a shipowner suffers, a major part of which is the replacement cost for the vessel and the time it takes to replace the vessel. The above figure also does not take into account the potential lost revenue as a result of partial damage that may occur to a ship. The statistics reported by Lloyd's Register were only for total losses of ships, which means the actual loss that the maritime industry suffered is still not accurately known.

Though under-represented these losses represent significant sums of money, especially to an industry that has long had to operate in a difficult economic environment. It also suggests that even small gains in the industry's safety record can have a large impact on the operational revenues of the industry. For example, if the maritime industry increased its safety standards which resulted in a one percent drop in total losses of ships in a year, the saving generated as a result of this would be US$5.4 million at the minimum.

Another method of assessing how much accidents cost the industry is to view the figures produced by Protection and Indemnity (P&I) Clubs. In 1993 the total number of claims received by United Kingdom Mutual Steamship Assurance Association (Bermuda) Limited (UK P&I Club) was 1,971 costing it US$ 989 million.

In addition to publishing figures the UK P&I Club analysed the claims its members made every year. Its report of 1992 stated that human error was the main cause of half of the claims they received with respect to cargo, as well as pollution damage. Sixty-five percent of the claims they received with respect to personal injuries were the result of human error. Human error was cited also as being responsible for 80 percent of the claims for damage to property to member ships, and for 90 percent of all the collision claims the club received (Parker, 1993). In their analysis for 1993 the UK P&I Club reported that three out of every five claims received could be attributed to human error. When the Club further analysed these claims they found that human error occurred more frequently on ships aged between 10 and 14 years old. The Club however failed to identify which aspects of human error were involved and therefore a more detailed picture of the offending behaviour could not be deduced.

Maritime accidents often result in the serious injury of people some of whom subsequently die. In 1998, 507 people lost their lives due to the total loss of vessels worldwide (Lloyd's Register of Shipping, 1998). The above figure suggests that sometimes multiple fatalities can occur in a single incident. For example, in 1998 the casualty figure was 507 as a result of the sinking of the Philippine registered Passenger/Roll-on, Roll-off (Ro-Ro) vessel, the 'Princess of the Orient' in a tropical storm, which resulted in the loss of 150 lives (Lloyd's Register of Shipping, 1998).

Goss (1991) queried the figures published by Lloyd's Register of Shipping and argued that they were understated. In his submission to the Select Committee, he cited his paper entitled 'Seamen's accidental deaths and injuries worldwide' that was produced for the Department of Transport (DTP) UK and Lloyd's Register. The paper extrapolated the injury and death rates that occurred to UK seafarers to make it representative of the injury rate that occurred in the broader International Shipping Industry. The most obvious discrepancy was between the projection reported in the paper and that of the officially reported casualty figures.

If the extrapolations made by Goss did reflect the true situation in the industry, then it also is clear that the data collected by Lloyd's Register were low and the problem was being understated. If the Lloyd's published figures were underestimating the problem and these were being used as the basis for taking remedial action, then the resultant remedial actions would clearly be inadequate.

From the above it is clear that the industry is aware that human error is an issue that causes the industry to lose a lot of money. There is however little evidence that the industry is taking steps to prevent the re-occurrence of these errors in the future (Select Committee, 1992).

1.1.3 Focus of the study

The description presented above outlined many issues that impacted on the working procedures of seafarers and the safety culture of ships. Some issues highlighted were the lack of /or dysfunctional communications that occurred between seafarers, shipowners/operators and Regulatory Authorities. The tensions that occurred between the demands of the compliance procedures by Regulatory Authorities and the problems associated with the implementation of these procedures were also noted. Other issues were the deficiencies of the training systems for seafarers and the lack of the same for shipowners, the inability of the Regulatory Sector to keep pace with the current rate of technological change, and the expectations under which seafarers operated as well as the reward system practised by the industry.

The cost of a poor safety culture was examined and it highlighted the deficiencies of the record keeping of the industry as well as the focus of the agencies that kept these records. This highlighted the need re-direct the focus of the industry toward issues that positively impact on the safety culture of a ship. This particular aspect has been chosen for the study, as it has not been examined systematically before.

1.1.3.1 Study aims

This study has one major and several minor aims. The aim of this thesis is to describe the organisational culture and climate of ships, as reported by seafarers regardless of their nationality or organisational affiliation, within the context of safe ship operations. The study investigates the responses of seafarers of different nationalities who work in many shipping companies. Thus this study aims to develop a framework of understanding the linkages that may occur between organisational culture, organisational climate aboard ships and maritime accidents. To achieve the above, the first aim was to understand what was the nature of the organisational culture and climate on board ships. The second aim was to examine how maritime accidents occurred, what were the most common form of accidents, and the frequency of occurrence of maritime accidents.

The study then seeks to analyse the responses of seafarers to determine whether any linkages between the above three issues existed, namely organisational culture, climate and maritime accidents. With these aims in mind, the following research questions guided the study.

1.1.4 Research Questions

The overall question this thesis aims to address is: 'In what way does maritime culture and climate influence maritime accidents?' The following research questions have been framed to address this aim.

1.1.4.1 **Research Question 1:** *How does a ship's crew perceive its organisational culture***?**

To address this research question the following sub-questions were developed:

- What observable behaviours do seafarers display when working aboard ship?
- What do seafarers value about their working environment?
- What assumptions guide the actions of seafarers?

1.1.4.2 Research Question 2: *Does a common organisational culture exist on all ships?*

To address this research question the following sub-questions were developed:

- Is the organisational culture the same on all ships regardless of nationality?
- Does a person's view of organisational culture depend on the department to which that person belongs?

1.1.4.3 Research Question 3: *What relationship exists between human error and maritime accidents?*

To address this research question the following sub-questions were developed:

- Is there a statistically significant difference in the rate of occurrence of accidents between different sizes of ship?
- Is there a statistically significant difference in the rate of occurrence of accidents between ships of different flag-states?
- Is there a statistically significant difference in the rate of occurrence of accidents between different departments working aboard a ship?
- Is there a statistically significant difference in the rate of occurrence of accidents between ships having different crew sizes?
- Is there a statistically significant difference in the rate of occurrence of accidents when correlated with the time-period a seafarer spends aboard ship?

1.1.4.4 Research Question 4: *How does a ship's crew perceive its organisational climate?*

1.1.5 Importance of this study

This study is significant in a number of ways. First, it is the first major study in the area of shipboard organisational culture and climate. It thus contributes data to what has been hitherto an under researched area. The thesis also adds a new dimension to the kinds of approaches that may be used when investigating an accident.

The study also highlights practices within the industry that contribute to an unsafe ship work culture. This is significant as not only were there practices aboard ship that impacted on ship safety, but there were practices, norms and values of shipping companies and many associated maritime bodies that may have a similar impact on ship safety as well. This study has for the first time attempted to examine issues that would be applicable to all shipping companies and identified associated bodies around the world.

1.1.6 Limitations of this study

This study seeks to ascertain the organisational culture and climate of the seagoing segment of the maritime industry. The organisation of a ship as a workplace is different from a normal shore-based work environment. Members of a ship not only have to work with each other but when they complete their work they also have to live in the same social environment as their work-mates. The questions in the instruments were directed at ascertaining a respondent's view of a workplace situation, ignoring the social aspect of shipboard life. It is highly likely that the social aspect may influence the nature of the climate of a ship.

While the intention was to apply the instruments as widely as possible in the maritime industry the bulk of responses came from persons attending various nautical institutes and studying for various courses. An inspection of the 'departments' segment of the instrument reveals that most of the respondents worked in the Navigation department. There were a few responses from the Engineering department and even fewer from the Ratings department. It is possible that the results could be 'skewed' in view of the above. Similarly the maritime climate data could mainly reflect the views of the Navigation department.

Ships also carry people who are generally spouses and children of the heads of department or to officers of the vessel. Though these people were associated with working members of the ship and would have a view of the culture as it existed aboard, their views were not sought in this study.

This study has focussed on the issue of whether or not the organisational culture aboard ships impacted on maritime accidents; however, it did not examine the relationship that the current maritime climate had with the same issue.

1.1.7 Overview of Thesis

The structure of the remainder of this thesis is as follows.

Chapter 2 presents a literature review of relevant materials including a variety of related and cognate disciplines, such as education and business.

Chapter 3 details the methodology used to address the research questions, including a description of the development of the instruments used in the research.

Chapter 4 presents the results of the research conducted as described in Chapter 3.

Chapter 5 presents the discussion of the results obtained from analysing the sample's responses and the conclusions drawn from them. It contains a discussion of the research questions stated in chapter 1 and draws conclusions from them. The chapter also consists of a section containing recommendations for further research.

1.1.8 Conclusion

The main focus of a shipowner has been on the economics of running a shipping company. Most of the major trends that have occurred in the maritime industry, in the recent past, can be understood if viewed from this context. In addition shipowners have sought to further their interests by joining the managing boards of Classification Societies and thus influence the way in which compliance procedures were framed.

Seafarers, on the other hand, work on board ships performing multiple tasks for which they have often received inadequate training. The crew were expected to work well together even though they may come from different countries and often to working standards that have not been explained to them. They typically bear the brunt of any consequences that may result from the occurrence of an accident, as all accident investigations and shipping companies focussed their attention on seafarers and their culpability in the accident. The most common result was that the 'responsible' seafarer was sent home.

There are many forces within the organisational culture of a ship that appeared to promote an unsafe culture. The principal cause being economic, but there were several others that had the same effect, e.g., the reduction of crew numbers aboard ship, the introduction of multi-cultural crews, poorly trained crews, inappropriate workloads and poor communication procedures between the ship and shipping company.

Many maritime organisations, which monitor accidents and the effect they have on the industry, focus on the economic impact of these events. They also identify the phenomenon that caused the accident but do very little thereafter to examine the underlying causes of the accident. It is possible that this constant focus on economic issues prevented other relevant bodies from developing a different focus and, therefore, solutions.

Chapter. 2

Literature Review

2.1 Introduction

This chapter is structured around the four Research Questions. The literature for this chapter has been drawn from a variety of sources and from cognate areas, such as Education and Business. The focus of this literature review has been on organisational culture, organisational climate, the human factors involved in accidents and maritime accidents.

The inter-disciplinary nature of this thesis and the inclusion of a wide range of concepts including the word limitations of the thesis have resulted in all areas not being dealt with in equal depth.

Table 4. Databases utilised to research Organisational Shipboard Culture and Organisational Shipboard Climate References.

Name of database	Reference Material
Delft University of Technology	Nil
US Library of Congress	Nil
Cardiff University Library	Nil
UMI/Pro-quest electronic	Nil
Australian Maritime College Library	Nil
Warsash Nautical Institute Library	Nil
IMO database on publications	1
National Library of Australia	Nil
University of Tasmania Library	Nil
University of Plymouth Library	Nil
University of Portsmouth Library	Nil
World Maritime University Library	1
Educational Resources Information Centre (ERIC)	Nil

An investigation of relevant databases in both maritime as well as related areas for appropriate references on organisational shipboard culture, organisational shipboard climate, maritime culture and maritime climate yielded only two appropriate published materials. Table 4 lists the databases searched and results obtained. This search highlighted the paucity of studies on the subject within the maritime sector and the necessity of using literature from cognate areas. It also highlighted the fact that any study focussing on this area needed to address issues that assisted in establishing the foundations of the subject. These areas may then be developed further by later studies.

The Chapter reviews literature illustrating relevant themes highlighted by each Research Question. It reviews key elements of context found within organisational literature, and reviews the methodological approaches used.

2.1.1 Research Question 1: *How does a ship's crew perceive its organisational culture?*

2.1.1.1 Definition and general description of `organisational culture'

Culture is an enduring set of values, beliefs, and assumptions that characterise organisations or societies, these include the shared philosophies, ideologies, expectations, attitudes and norms of their members (Kilman, Saxton & Serpa, 1985; Schein, 1985).

All cultures regardless of size may be described using three criteria. These criteria may also be regarded as the stages through which cultures evolve, in their passage from a loose collection of individuals to that of a distinct culture (Schein, 1985).

Stage One or the first stage through which a culture passes is referred to as the 'Observable Behaviour' stage; here the focus are on the observable behaviours displayed by members of a culture and the visible artefacts displayed by its institutions. Stage 2 is the 'Values' stage or the criteria that members of a culture used to evaluate their external interactions with others and assess whether they had achieved the culture's objectives.

Stage 3 is the 'Assumptions' stage; where assumptions are the unspoken and unthought of principles guiding the activities of members of a culture (Schein, 1985).

Some studies described in general terms the characteristics of each stage of a culture (Geertz, 1973; Adams, & Ingersoll, 1985; Dyer, 1985; Lorsch, 1985; Wellins, Byham & Wilson, 1991). Other studies however, only concentrated on identifying defining aspects within each stage (Deal & Kennedy, 1982; Smircich, 1983; Kilman, Saxton & Serpa, 1985; Sathe, 1985). A third group of studies focussed on common identified factors which existed in the cultures of multi-national and other multi-organisational cultures (for example, Schein, 1985; Louis, 1985b). The studies carried out by the first two groups were important to this study as they identified the paradigms and factors that were to be examined in each stage of cultural development. It was the studies by Schein (1985) and Louis (1985b), however, that were considered even more important by this study, as they examined issues that were considered 'normal' both within and across multiple work settings. The examination of similar cultural phenomena across work settings is what would be required in a study that examined the organisational cultures of ships from all around the world. An important issue that this study had to deal with was whether or not the organisational culture aboard ships was homogenous internationally.

Another reason this study chose to adopt a focussed approach was that the issues being dealt with were wide-ranging and an examination of issues not directly supporting its objectives would only diffuse its focus without clarifying those issues that the study considered important.

2.1.1.2 The Observable Behaviour or Stage 1 of culture development

Organisations have informal control mechanisms that pattern relationships and influence the formation of a culture. Thus an organisation is instrumental in modifying the behavioural responses of organisational members. The results of this modification were evidenced by changed observable behaviour amongst organisation members

(Sapienza, 1985; Sethia & Von-Glinow, 1985). An example of this would be the results of interaction between a HOD and other members of the department, where the HOD's responses or actions acted as a catalyst that assisted in the behaviour modification of subordinates. Such interactions were in accord with the concept of 'social cognition' proposed by Putnam & Borko (1997) who suggested that the way people thought and reasoned were in part a product of their inter-personal interactions with other organisational members. They also suggested that sustained positive interaction between organisation members resulted in individuals sharing common ways of thinking and communicating.

The issues focussed on by this study were, first, the interpersonal interactions between seafarers and their Heads of Departments (HOD) and second, the interactions between seafarers and persons working in the Regulatory Sector or in Shipping/Ship-management companies. As the study recognised that these interactions played a major role in the development of the behavioural patterns displayed by seafarers (Schein, 1985), and these behaviours may have a significant impact on the safety culture of a ship. It is the aim of this study to examine all issues impacting on a ship's safety culture.

2.1.1.3 The Values stage or Stage 2 of cultural development

Literature (for example, Schein, 1985; and Owens & Steinhoff, 1989) reported that the determination of a common set of values was important in deciding whether the organisational culture aboard a ship was the same for all ships, or not.

Values were those unique interactions, activities and procedures developed by organisations to guide the daily activities of its members. These values can be thought of as an internal system or environment (Bates, 1981), which once formed influenced the organisation's external environment. These values were therefore the 'shades' through which organisational members (i.e., seafarers) viewed their external environment and were the filters they used to help identify and generate values after interaction with the external environment had occurred. This issue is important to the study as knowing how seafarers approached and then reacted to an interaction with members from, say, the Regulatory sector/ Shipping Company would assist in identifying their ‘Values’.

All organisations have core values, or values that described the essence of their functioning or philosophy (Deal & Kennedy, 1982). The importance of these collective beliefs, social meanings and shared history of experience provide an insight into what individuals in the group value. Aligning a ship’s operational procedures to support these core values would have a positive impact on a ship’s safety culture (Zohar, 1980) therefore ascertaining what seafarers’ value is important to the study.

It is also important to determine how a seafarer would react if changes were introduced aboard a ship, as changes which aligned with seafarer values were more likely to be supported by them, as opposed to changes which did not (Harbst & Madsen, 1993).

2.1.1.4 The Assumptions stage or Stage 3 of cultural development

Studies that examined the human subconscious in a cognate area such as psychology identified many of its component variables (Berger & Luckman, 1966; Black, 1962; Boulding, 1973; Forgus & Shulman, 1979; Schön, 1979; Schutz, 1967). Studies from other cognate areas only focussed on identified factors that directly related to the objectives of their study (Berg, 1984; Grady, Fisher & Fraser, 1996; Lakoff & Johnson, 1980; Macrae, 1975; Reddy, 1979; Sonntag, 1989; Tracy, 1979; Witkin & Schein, 1986). This study uses the latter approach by focussing on the ‘assumptions’ held by seafarers to assist in providing a contextual explanation for their actions. As seafarer interaction with their external environment was one of the foci of this study it was important to understand some of the underlying factors that guided seafarer behaviour.

Assumptions dealt with what people in an organisation accepted as ‘true’ or ‘false’ (Owens & Steinhoff, 1989), were taken for granted (Schein, 1986), and regarded as non-negotiable (Hare, 1962). Other literature (Berger & Black, 1979b; Luckman, 1966; Schön, 1979) suggested that this information was symbolically coded into a human being's subconscious which provided the basis for the creation of a symbolical universe within which organisational members functioned. Metaphors were this symbolical code used for storing 'assumptions' in the subconscious (Schein, 1986).

Schein (1985) listed some 'assumptions' that appeared to form the core of and around which cultural development occurred. For example, what was considered to be the right way for people to relate to each other? How was power distributed? Was it based on traditional lineal authority? Law? Charisma? Or, some other basis? For example, the diagrammatic power structure of a ship, (see Table 1 in Chapter One) illustrated a traditional linear hierarchical model. Such a structure suggested that the organisational culture of a ship could be described as Formalistic. The realities of life on board however dictated that seafarers worked as members of a team and these teams necessarily had to function efficiently. The described circumstances suggested that the shipboard organisational culture could also be Collegial. Some literature (e.g., Gordon, 1985) suggested it was possible that the behaviours demanded by each culture were different and could also be in conflict with the other and this conflict in turn may impact on the safety culture of the ship. The alignment of the operational environment of a ship with the assumptions of seafarers may improve the safety culture of a ship (Zohar, 1980) and therefore this also was an issue that required examination by this study.

2.1.1.5 The impact of different types of cultures on human behaviour

Culture had a significant impact on both the individual as well as corporate behaviour of members (Bates, 1981; Davies & Weiner, 1985; Deal & Kennedy, 1982; Dyer, 1985; Etzioni, 1964). Strong cultures had a much larger impact than weaker cultures (Schein, 1985) and were the most resistant to change (Gordon, 1985).

Organisational cultures may be categorised according to generic archetypes. Some studies grouped organisations according to their organisational processes and observed behaviours (Bennis & Nanus, 1985), information processing styles (Quinn & McGrath, 1985) and organisation types and technology used (Roberts, Rousseau, & La Porte. 1994). The literature showed strongly that different studies described organisational culture using different criteria. Examining both the behaviour and processes on board ship are important, as the main focus of this study is on the impact of seafarer behaviour on the safety culture of a ship.

Bennis and Nanus (1985) stated that most organisational cultures displayed the general characteristics of one or more of three distinct types, namely: Collegial, Formalistic, and Personalistic.

In a *collegial* organisation the dominant emphasis was on consensus, peer-group membership and teamwork (Bennis & Nanus, 1985). The cues for such a style were discussions, participation, and consensus by members. The management of these organisations viewed the maintenance of cohesion as a desirable objective. This was usually achieved by paying close attention to the climate, morale, and by fostering teamwork among members (Quinn & McGrath, 1985).

A *formalistic* culture prescribed behaviour according to explicit rules and policies (Bennis & Nanus, 1985). Documentation, computation, and evaluation were the observable cues. Issues such as stability, control, and coordination formed the main focus of the management of such an organisation. The desirable objective for the culture was the continuity of the organisation (Quinn & McGrath, 1985).

A *personalistic* culture's dominant theme was on the person, where the locus of decision-making rested with each individual (Bennis & Nanus, 1985). Desirable objectives for such a culture were the revitalisation of an organisation using external support, resource acquisition, and growth as the necessary tools.

The study by Roberts et al., (1994) is important to this thesis as it is the only study that investigated seafarer responses on the subject of organisational culture. Roberts et al's., (1994) research, which was conducted on an aircraft carrier, focused on four areas, namely, operational decision-making, interdependence of units, culture of high reliability and adaptation of an organisation to technology. It also focussed on issues that resulted in paradoxes or tensions in a ship's operations. Only two of the areas researched by Roberts et al., (1994) were directly relevant to the current study, these were operational decision-making and interdependence of units (i.e., seafarers).

Roberts et al's., (1994) study grouped responses into dimensions or styles; the first, labelled 'Satisfaction style', revealed the dominant values of 'achievement', 'self-actualisation', 'humanist-helpful' and 'affiliation'. The style supported innovation, risk taking and teamwork as means of achieving listed values. This description matches that provided by Bennis & Nanus (1985) for the behaviour displayed by members of a Collegial organisation.

Another dimension labelled 'Task security style' revealed the value of 'predictability'. The style supported 'control' and 'regulation of task behaviour' as means of achieving the organisation's goals. When the style was split between other factors the study found that though the culture supported the maintenance of security-oriented relations, these relations involved a strong task component. 'Predictability' 'control' and 'regulation of task behaviour' matched the description provided by Bennis & Nanus (1985) for the behaviour displayed by members of a Formalistic organisation.

The findings by Roberts et al., (1994) pointed to a conundrum; where on the one hand the 'Satisfaction style' suggested that seafarers valued a 'Collegial' style of functioning, whilst on the other hand the 'Task Orientation' style suggested that seafarers operated at a 'Formalistic' level as well. The two styles demand significantly different behaviour from members. A collegial culture promoted a high level of interaction between organisation members and it was likely that in similar circumstances a collegial organisation may use a different solution to address similar issues, i.e., the solution arrived at was tailored to the specificity of the different circumstances. This is something a Formalistic organisation avoided, as it demands a uniform response for categorised issues. Seafarers, while working aboard ship, could thus be presented with a situation that required them to choose between a standardised response or a tailored one which addressed the complexity of the situation. It is clear that each organisational culture described above would produce a different response to the situation. The impact that this decision had on the safety culture of a ship is important to this study.

Roberts et al's., (1994) study also found a strong 'Avoidance' style loading on all factors. This suggested that avoidance behaviour played a complex role in the organisational culture of an aircraft carrier. Earlier in this thesis some of the circumstances that encouraged the display of avoidance behaviour by seafarers were outlined. The study by Roberts et al., (1994) provided the first published empirical evidence that seafarers did indeed display defensive behaviour. The precise causes that triggered this defensive behaviour are an area that this study is very concerned with as it could adversely impact on the safety culture of a ship.

2.1.1.6 Metaphors

In concluding the discussion of this Research Question, it is appropriate to consider the topic of 'metaphors' and its relationship with this study. The literature suggested that they were the code that the human subconscious used to store information such as `assumptions' (Schein, 1985).

Some studies argued that one of the best methods for eliciting symbolic information was to use metaphors (Berger & Luckman, 1966; Black, 1979b; Schön , 1979) as metaphors opened up a phenomenon to a number of connotations at various levels (Lakoff & Johnson, 1980; Dandridge, 1985). This made it easier for all people – as 'interpreters' - to attach their particular connotation to a certain metaphor and find images or associations that conveyed its essence.

Hawkes (1972) defined metaphors as a particular set of linguistic processes whereby the aspects of one object were transferred to another, so that the second object was spoken of as if it were the first. Krefting & Frost (1985) extended the concept and stated that a metaphor was usually the explanation of one thing, known as `the topic', in terms of another, known as `the vehicle'. The topic and vehicle however were not the same but shared some characteristics, known as `the ground', but not others and these differences were known as `the tension'. Metaphors tended to be highly memorable as they were succinct.

A metaphor therefore was a linguistic concept that used the property of expanding reality by likening one thing with another. As metaphors allowed the transfer from the familiar to something less familiar, they helped articulate subjects for which no specific language existed (Krefting & Frost, 1985). Schlechty & Joslin (1986) put the point well, by stating that 'metaphors formed the basis surrounding serious efforts at developing comprehensive descriptions, explanations and predictions of events'. Well-chosen metaphors could be the starting point for the development of a theory, i.e., all deliberate human action had a cognitive basis reflected in espoused theories and theories-in-use (Argyris & Schön, 1978). As this thesis is the starting point for the development of theory with respect to the Organisational Culture of a ship, metaphors were chosen as the vehicle to help explore the 'assumptions' held by seafarers.

2.1.2 Research Question 2: *Does a common organisational culture exist on all ships?*

This second Research Question is linked to Research Question One as it provided the overarching framework utilised by this study to investigate the Organisational Culture of a ship. Some studies on accidents identified language difficulties (Harbst & Madsen, 1993) and inter-seafarer communications (Couper, Zade, Trenkner, Herrera & Coupland. 1996; Goss, 1991; Hopkins, 1991), as factors that caused or exacerbated the consequences of a maritime accident. In these studies the culture referred to was the ethnic culture of the crewmembers concerned, and each study treated this ethnic culture as homogenous and holistically. While language may be the unique way in which each culture's members communicate, it was only one of many components that together formed a culture (Black, 1962; Hinkel, 1999). These studies highlighted the lack of attention paid by shipowners/operators when they hired crews from a country other than the resident flag state and some of the resulting consequences. The studies did not address however, the issue of the organisational culture of a ship concerned (Håvold, 2000).

Section 2.1.1.1 dealt with studies that were carried out on organisational culture. The following sections examine the impact that ethnic culture might have on the organisational culture of a ship, and examine issues that relate to the formation of sub-cultures aboard a ship.

2.1.2.1 Intercultural interactions and its effect on culture

In a cross-cultural setting, individuals bring with them particular ways of interacting and have expectations that were not necessarily shared by members of another culture. As an example, people from many Latin American and Asian countries, (hereinafter referred to as Latin-Asians), closely intertwined work with social relationships (Brislin, Cushner, Cherrie & Yong. 1986). Euro-Americans or persons who lived in what is loosely termed as 'Western' countries approached their work using the skills of precision, perseverance, task completion and punctuality; social contact was not considered important by them to determine operational efficiency (Brislin et al., 1986). It is clear that these two approaches were not always compatible and could provide the necessary conditions for misunderstandings to occur, if persons from each of these two groups were made to work together with no period of familiarisation allowed for each to adjust to other's different work approaches.

Inter-ethnic interactions similar to that described by Brislin et al., (1986) were likely to occur on ships with multi-ethnic crews. Typically neither group had been trained to understand the attitudinal differences that each group had toward relationships and work (Håvold, 2000). These interactions have been the subject of some earlier examination (Couper et al., 1996; Goss, 1991; Hopkins, 1991; Harbst & Madsen, 1993) and it was concluded that these interactions disrupted the normal communication patterns of a ship which, in turn, lead to the deterioration of the safety climate of a ship.

An observer briefly acquainted with a knowledge of the different operating styles between the two groups may conclude that ships belonging to the shipping companies from the Euro-American group of countries may have different organisational cultures vis-à-vis that of Latin-Asian shipping companies.

It is important for this study to determine the impact that interaction between members of different ethnic communities on board have on the organisational culture and on the safety culture of a ship. It is also important for the study to ascertain whether a single homogenous culture existed on all ships.

2.1.2.2 Sub-cultures

Some studies suggested that large organisations had many factors that were thought to promote the formation of sub-cultures (Geertz, 1973; Louis, 1985a, 1985b, 1986; Quinn & McGrath, 1985; Sathe, 1985). The factors cited were; autonomous departments, branches located in different geographic areas, department members using distinctly separate jargon or belonging to separate professional organisations. For example, on board ship the Deck and Engineering Departments were both autonomous, with each having their own highly developed jargon. Deck Officers could become members of a professional organisation such as the Nautical Institute or the Royal Company of Master Mariners while the Engineers could do the same by becoming members of the Royal Institute of Marine Engineers.

A sub-culture could also develop in a department, which had a different goal from the rest of the organisation (Louis, 1986). For example, the goal of a Deck Department when the ship was in port was to load the ship as efficiently and as quickly as possible, whereas in the same circumstances the goal of the Engineering Department would be to carry out machinery maintenance and they would have preferred the ship to remain in port longer, as this would allow extra time to enable them to carry out more maintenance tasks.

Some studies (Handy, 1976; Davies & Weiner, 1985; Dyer, 1985; Kilman et al., 1985; Krefting & Frost, 1985) argued that the emergence of a sub-culture was far more complicated than was being suggested and it was possible, in fact, that sub-cultures would not form even if identified conditions existed in the area of concern. It is possible that other conditions or interactions may have to occur before a sub-culture formed. This was particularly pertinent for this study as the work environment for the members of each department had many of the factors described above and, which favoured the formation of sub-cultures. The determination of the existence of sub-cultures aboard a ship is important to this study, as it would impact on the interactions between seafarers of different departments which in turn could impact on the safety culture of a ship.

2.1.3 Research Question 3: *What is the relationship between human error and maritime accidents?*

The previous two Research Questions reviewed literature broadly relevant to Organisational Culture and it is important to note that most of it came not from an examination of shipboard organisational culture studies but from cognate areas. This became necessary due to the lack of published material in the maritime area. Another important issue for this thesis was the safety culture of a ship with the focus on the seafarer interactions. The current Research Question focuses on maritime accidents and the factors that caused them. The most prominent factor identified in the literature was 'human error' which will be examined in some detail in the following section. The Research Question also examines other factors which when acting in conjunction with human error may be partly or wholly responsible for the occurrence of accidents. The concluding section examines the safety record of the industry and the results of maritime accident investigations that have occurred.

2.1.3.1 Human error and its impact on ship safety

Given the central role that the safety environment of a ship plays in this study, research examining the impact of human error on safety will be explored more closely.

Rasmussen's (1980) study into errors that occurred in safety critical industries led to the development of a framework that assisted in error categorisation. This framework was known as the Skill-Rule-Knowledge (SRK) error framework. Skill-based errors are those that typically involve absent-mindedness and also may be related to variability in the coordination of motor function, or the failure to detect sensory input. Rule-based errors however occurred in familiar situations and often involved problems that called for explicit expertise. Rule-based errors included wrongly classified situations leading to the selection of the wrong rule, or the incorrect recall of procedures. Knowledge-based errors occurred as a result of failed problem solving and/or lack of system knowledge (Rasmussen, 1980, 1982, 1983).

Reason (1987) initially used Rasmussen's framework as the basis for developing the Generic Error Modelling System (GEMS). In this model Reason (1987) added another error called 'violations' as a separate category. A violation is defined as a deliberate deviation, from those practices deemed necessary to maintain the safe operation of a potentially hazardous system (Reason, 1990). The GEMS model is now one of the most widely used error frameworks in the study of accidents (Lucas, 1997;

Hobbs & Williamson, 2002). It was argued by Reason (1987) that if the maritime industry used the GEMS model it would help address many deficiencies of the current accident investigation system. Currently maritime accident investigators primarily used a phenomenological taxonomy, which focused on the observable manifestations of errors, such as errors of commission and omission and the events that immediately preceded the event itself (Filor, 1994). The investigations therefore rarely examined the underlying causes of an accident.

2.1.3.1.1 Results of maritime accident studies

Table 5 lists the studies that were carried out on maritime accidents between 1984 and 1997 and were reported in the literature. The causal factors identified by each study were listed also. An analysis of the findings of the accident investigations revealed that the factors 'poor ergonomics' and 'fatigue' were cited more frequently than any of the other categories. The errors committed, therefore, could be categorised as Skill-based errors (Williamson & Feyer, 1990; Salminen & Tallberg, 1996; Hobbs & Williamson, 2002).

The next most cited factor was 'poor/no training' which can be categorised under Rule-based errors. It is clear from these studies that Skill-based errors were the most frequent causes of maritime accidents. What is of even more concern is that Skill-based errors tend to precede fatal accidents (Salminen & Tallberg, 1996) and Health and Safety incidents (Hobbs & Williamson, 2002). Health and Safety incidents were precipitated by a failure to observe health and safety guidelines (Hobbs & Williamson, 2002).

Shapovalov's (1992) study supported the above finding and concluded that the deck crew had the most fatal accidents on board ship. This conclusion was supported by Nielsen's (1998) study on work related fatalities on Singaporean ships. Jaremin's (1997) study, however, did not find a statistically significant difference in the number of fatalities between any of the ship's departments.

Table 5. Summary of factors identified in major studies as causes of maritime accidents.

Study	Year	Factors
Olkinoura	1984	Alcohol
Helmkamp & Bone	1986	Noise, Confined environment, long working hours, irregular working hours, sleep deprivation, Lack of privacy
Monk, & Folkard	1985	Task monotony, sleep deprivation,
Helmkamp & Bone	1986	Noise, confined environment, poor working hours, fatigue, lack of privacy
Filikowski	1989	Vibration, noise, microwave radiation, alcohol, hyper tension
Wagenaar	1990	Alcohol, poor ergonomics, physical stress, poor training, fear, poor motivation, permissiveness toward unsafe acts, false hypothesis, fear, poor motivation
Moore & Bea	1992, 1994	Alcohol, poor ergonomics, fatigue, poor/no training, sickness, Panic, shock, inattention, anxiety, confusion, negligence, calculated risk
Maritime Transportation Research Board (MTRB) study	1992	Panic or shock, drunkenness or drug influence, inattention, anxiety, negative transfer of training, ignorance, fear
Shapovalov	1992	Breach of safety measures
Brandt, Kirk Jensen, Hansen	1994	Alcoholism
U.S Coast Guard	1995	Poor ergonomics, ship motion, poor/no training, poor company standards, poor communication systems, lack of accident investigation, non sharing of information
Sanquist et al	1996	Noise, confined environment, poor working hours, fatigue, lack of privacy, ship motions, vibration
Finland	1997	Fatigue, poor training procedures, poor ergonomics, poor communication systems, Poor shore management, idiosyncratic operational procedures
Cantwell	1997	Poor ergonomics, fatigue, ship motion

Hobbs & Williamson (2002) classified incidents into 'quality incidents' or incidents that could have been precipitated by a lapse in the quality of the task or system being performed. They found that quality incidents were most likely to follow from memory lapses.

Hopkins (1991) suggested another factor, which he called *Groupthink,* may have assisted in the generation of error prone behaviour. Here members of a group consulted, agreed and implemented a particular action, yet every person had misgivings and worries about its implementation and outcome. Thus a group or team could collectively implement some later calamitous action because avoidance of 'losing face' seemed more important than the safety of the individual or the group. The study by Roberts et al., (1994) supported this conclusion within the context of seafarer behaviour. Roberts et al., (1994) found that avoidance behaviour played a complex role in overall seafarer behaviour and was a factor that loaded on all the values identified by the study. It thus appeared that there were conditions onboard a ship that made seafarers act in away that was detrimental to the safety of the ship. Consideration of any factor that impacted on the safety culture of a ship is important to this study.

2.1.4 Research Question 4: *What is the nature of the ship's organisational climate as viewed by its crew?*

This Research Question is concerned with the current shipboard climate, as current events in the maritime industry impact on individual seafarers in particular ways and may, in the long term, also impact on the Organisational Culture of a ship. To achieve the objectives of this Research Question literature on organisational climate from cognate areas will be examined and the organisational climate on board a ship considered within this context.

It should be noted that all of the maritime related literature, which is reviewed in the context of the organisational climate aboard ship, come from studies carried out on the medical ailments of seafarers. The causal factors of the described ailments identified by these studies can be linked to the maritime climate of a ship and hence their relevance to this Research Question. However, as a result of the divergent aims of this study and the cited medical studies only relevant aspects are included for consideration.

2.1.4.1 Organisational Climate

It is important to distinguish between Culture and Climate. Organisational Culture is pervasive and largely driven by factors not often discussed by employees (Sergiovanni, 1987). Organisational climate however is the environment in which employees find themselves working. Thus culture dictated the procedures necessary to accomplish a task, while climate is largely responsible for the state of mind of the person accomplishing it. If a person was in a happy frame of mind and focussed on the task at hand, a successful outcome may be anticipated. If however the same person was unhappy or not focussed on the task, though the same procedures were followed the outcome may not have been the same (Sergiovanni, 1987). Understanding a ship's organisational climate thus gives an insight into seafarer actions and feelings (Moos, 1986).

In addition, organisational climate can have a strong influence on people within a work setting (Moos, 1986). Sergiovanni (1987) cited three important human characteristics associated with organisational climate. The first is the feeling by people that their lives and occupations were meaningful. The second was the need for people to feel that they had reasonable control over their work activities. The last was a person's need to experience success and receive recognition for it.

This issue has relevance to the study as circumstances described earlier highlighted the possibility that seafarers were being disempowered; for example, by not allowing them input into the process of framing procedures designed to improve the efficiency of the industry (Goss, 1991). Attention or inattention to these issues could significantly impact upon the climate of an organisation (Deal & Petersen, 1984). While it is acknowledged seafarer needs in these areas were being ignored it was not clear how this impacted on a ship's safety culture. Identification of factors that impinged on the climate of a ship was important to this study as it assisted in better understanding the issues that impacted on the safety culture of a ship.

2.1.4.2 Maritime climate

Unlike many other industries seafarers work in a unique environment and encounter conditions not usually found in what is traditionally considered a work place. For instance, they have to live with the people they work with, which in this case is on a ship. This closeness, as will be demonstrated, does have an influence on a seafarer's state of mind (Barnes, 1984). Studies show that the physical and emotional state of seafarers (Hart, Bea & Roberts, 1994), inadequate hiring policies of a shipping company and poor equipment design (Moore & Bea, 1992) were factors that induced seafarers to commit errors. Table 5 summarises the factors that accident investigations identified as the causes of maritime accidents. The two areas that were cited most frequency were 'poor ergonomics' and 'fatigue', followed by 'Alcoholism'. Table 6 is a summary of the studies conducted in cognate areas on the factors that impacted on accidents. A perusal of Table 6 revealed that 'time of day' was cited the most frequently as a cause of accident followed by 'task monotony', 'sleep deprivation' and 'Alcoholism'. The causes of maritime accidents and those that occurred in the other cognate studies differed in that 'Poor Ergonomics' was not seen as an accident causing factor in the cognate areas while `Fatigue' did not feature as prominently as it did in maritime accidents.

Table 6. Factors contributing to accidents reported in cognate studies.

Study	Year	Contributing Factors
Feyer, Williamson, Jenkin, Higgins	1993	Time of day (circadian rhythms)
Williamson, Feyer, Coumarelos, Jenkins	1992	Time of day (circadian rhythms)
Van Ouwerkerk	1987	Time of day (circadian rhythms)
Green	1985	Sleep deprivation
Davies, Schackleton, Parasuraman	1983	Task monotony
Rodahl	1977	Task monotony
Von Wiegand	1972	Alcoholism

'Poor Ergonomics' and 'Fatigue' were factors that caused Skill-based errors (Williamson & Feyer, 1990; Salminen & Tallberg, 1996; Hobbs & Williamson, 2002), and they tended to precede fatalities (Salminen & Tallberg, 1996; Hobbs & Williamson, 2002).

The appearance of 'Poor Ergonomics' is significant as it indicates that the design of the work spaces and the siting of instruments on board a ship make a significant contribution to maritime accidents. The design of workspaces and the siting of equipment on board a ship were done without consulting the seafarers who have to work in these spaces and operate this equipment (Card, 1995). It highlights Sergiovanni's (1987) statement of the need for people to feel they had reasonable control over their work activities. The importance of this variable is acknowledged here to highlight its possible impact on the safety climate of a ship. Understanding the conditions in which seafarers lived would perhaps give the study some clues on how seafarers reacted to their physical environment and how this in turn impacted on the safety culture of a ship.

The presence of fatigue had been detected in many maritime accidents though not as its main causal factor (Finland, 1997). It was observed also as the cause for higher than normal seafarer injury hospitalisation rates (Helmkamp & Bone, 1986).

Factors that increased the level of fatigue in a person included the amount of time spent on task (Sanquist, Raby, Maloney, & Carvalhais. 1996), the time of day when the task is performed (Feyer, Williamson, Jenkin, & Higgins. 1993; Van Ouwerkerk, 1987; Williamson, A., Feyer, Coumarelos, & Jenkins.1992), and the level of task monotony associated with the performance of that task (Davies, Schackleton & Parasuraman. 1983; Monk & Folkard, 1985; Rodahl, 1977). Other factors that appeared to impact mainly on seafarers were experienced weather conditions and vibration of the ship (Sanquist et al., 1996), reduced total sleep time per 24 hour period (Nitka, 1990), fragmented sleep, sleep at physiologically inappropriate times of day; insufficient time between shifts, reduced quality main sleep;

(Sanquist et al., 1996; Feyer et al., 1993; Williamson et al., 1992), the age and medical condition of the seafarer (Cantwell, 1997).

However, as they are variables that have been considered elsewhere and their importance acknowledged here, the focus of the thesis will be upon an examination of other variables and possible contributory factors integral to the safety culture of a ship.

The impact of alcohol on the safety climate of a ship had been considerable in the past (Hope, 1990). Studies on the impact of alcohol show that seafarers had a higher than normal rate of contracting cirrhosis (Brandt, Kirk, Jensen & Hansen. 1994; Filikowski, 1989; Olkinuora, 1984) and that alcohol responsible for the occurrence of accidents (Von Wiegand, 1972; Hope, 1990; Wagenaar, 1990).

A trend study between 1971 and 1992 indicated that the rate of occurrence of cirrhosis amongst seafarers had declined significantly (see Appendix 3, Table 35) (Filikowski, Renke & Rzepiak.1992). This study however may have limited applicability as it sampled only Polish seafarers, at a time when the country was moving to a new democratic system of governance. Another study on Danish seafarers listed cirrhosis of the liver as the tenth highest cause of death (Brandt et al., 1994), it however did not have a trend analysis to confirm Filikowski et al's., (1992) findings. Wagenaar's (1990) study did cite high levels of alcohol consumption as affecting the safety culture of a ship but did not quantify its effect (see Appendix 3, Table 36). There have been no other published studies to establish the extent to which alcoholism currently affected the industry.

Clearly alcohol abuse and alcoholism among personnel are important matters and these findings fit with earlier research (see for example, Filikowski, 1989; Brandt et al., 1994). However, as they are variables that have been considered elsewhere and their importance acknowledged here the focus of the thesis will be upon an examination of other variables and possible contributory factors integral to the safety culture of a ship.

Apart from factors that affect a seafarer's physical health, the marine environment also appeared to impact on the mental health of seafarers. Filikowski (1989) reported that seafarers seemed to be more affected by mental illnesses than any other ailment, with officers being more prone than Ratings (Nitka, 1990).

Psychiatric illnesses resulted in a decreased ability of the seafarer to cope with job expectations and had an impact on the safety culture of a ship (Barnes, 1984; Green, 1985). Studies showed that emotional disturbances, psychoses (Levy, 1972; Filikowski, 1989), psychoneuroses (Nitka, 1990; Barnes, 1983), psychosomatic diseases (Barss, 1990) and emotional problems ashore (Levy, 1971) were among the most important causes of seafarer mental illnesses (See Table 7).

Table 7. Studies on the non-physical factors that affect seafarers.

Study	Year	Contributing factors
Levy	1971	Psychiatric illnesses
Barnes	1984	Mental health
Filikowski	1989	Neuroses, arterial hypertension, ulcers, renal calculi, alcohol addiction
Wagenaar	1989	High stress situations, social pressure
Barss	1990	Low back injuries, psychiatric illnesses
Nitka	1990	Psychiatric illnesses
Filikowski et al	1992	Neuroses, arterial hypertension, ulcers, renal calculi, alcohol addiction

Wagenaar (1990) identified high stress situations as well as social pressure as the two main factors that degraded the information processing systems of seafarers. Wagenaar (1990) also reported that the decision-making capability of a seafarer was affected by that person's personality, which appeared to promote error generation behaviour and was linked with high levels of neuroticism (Hagart & Crawshaw, 1981).

The above studies were important as they identified some of the main mental afflictions suffered by seafarers, which in turn highlighted the impact that they had on the safety culture of a ship. These studies were additionally important as they identified many of the underlying causes of the described afflictions, which the current study examined to assess the impact they had on the organisational climate of a ship. Understanding conditions that impact on the safety climate of a ship is one of the main foci of this study.

2.1.4.2.1 Summary of the Organisational Climate of a ship

Poor ergonomics, fatigue, alcohol and poor training appeared to be the main issues that affected the well being of seafarers on a ship. They were identified also as causal factors for maritime accidents. The organisational climate aboard ship created many pressures that appeared to contribute to the deterioration of the mental health of seafarers. The focus on these issues was important as they assisted in facilitating understanding of many of the factors that were underlying causes associated with the safety culture of a ship.

2.1.5 Summary of the Research Questions

Research Question One explored the nature of organisational culture using literature from cognate areas and related those materials to the maritime industry. Research Question Two examined the crucial aspect of whether or not the organisational culture aboard all ships was the same or differed according to nationality of the ship. Research Question Three reviewed literature related to human error from cognate areas, as there was little specific literature in the maritime field. Research Question Three also examined investigations carried out in the aftermath of maritime accidents. The conclusions arrived at by these accident investigations cited many causal factors that had relevance to the current study. Research Question Four was concerned with the current shipboard climate, as current events in the maritime industry impact on individual seafarers in particular ways and may, in the long term, also impact on the Organisational Culture of a ship.

The following chapter describes the subjects, instruments and methodology used to conduct the survey.

Chapter. 3

Methodology

3.1 Introduction

The previous chapter reviewed literature relevant to this study. The broad aims of the study were first to describe Organisational Culture and the Organisational Climate aboard ship within which seafarers operated and second, to determine the impact that the above had on maritime accidents. To address these matters an appropriate methodological approach was needed. This chapter discusses the research approach considered appropriate for the Research Questions. It then discusses the instruments used for the purpose; outlines the background to the research project; describes the processes involved in participant selection; and summarises the verification procedures to maximise the validity and reliability (Burns, 2000; Gay, 1992) of the research findings.

3.1.1 The Research Approach

This study used a research approach that combined elements of quantitative and qualitative methods. This mixed-mode was deemed the best way to proceed as the research questions did not fit a single approach. Also the researcher wished to utilise data gathering approaches that have been used in both broad research approaches, i.e., a questionnaire, metaphorical analysis, document analysis. This mixed-mode approach has been advocated by authors such as Gall, Borg & Gall (1996), Brown & Dowling (1998), Burns (2000) and Robson (2002), as it allowed the investigation of questions and issues where there was a bounded system (Burns, 2000) but the participants were dispersed and not readily accessible for extended, face-to-face data gathering. The issues relating to the reliability and validity of the data gathering approaches and the subsequent generalisability of the findings will be discussed later.

As indicated in earlier chapters there is little or no literature dealing specifically with the organisational culture and climate on board a ship. It will be recalled that one study (Roberts et al., 1994), only partially related to the focus of this thesis, had been identified. An initial foray into the workplace, for the purpose of identifying issues, consisted of ten unstructured interviews with seafarers.

3.1.1.1 The Study's Sample

All seafarers that worked aboard a ship were identified by the study as the possible population. As the results were intended to be generalisable across the whole seafaring population of the maritime industry, the selected sample population would have to represent the views of seafarers from all flag states (Gay, 1992). The larger the size of the sample and the more flag state ships involved would enable a more confidently generalisable picture to emerge (Gay, 1992).

The nature of seafaring disperses seafarers very widely across the globe on board many ships. Thus as individuals they were clearly not easily accessible. When seafarers went home on leave they dispersed even more widely to their homes. It then became necessary to identify areas or means of getting into contact with them more efficiently. Two avenues were identified, the first were Nautical Training Institutes where seafarers congregated for training purposes. The second method was to contact them through their professional organisations, like the Nautical Institute. The method that best suited these approaches was cluster sampling (Gay, 1992). The target population therefore was all those seafarers who were studying at various maritime educational institutes and those seafarers who were members of their respective professional organisations. To obtain data in which there was a high confidence in its generalisability it was decided to use the maritime institutes located in as many different countries as possible. Each of these institutes would also have seafarers of different nationalities and this would help make the sample responses broader and therefore more generalisable (Gay, 1992). The methodology reflected the need for quantitative data to be gathered at the whole seafaring industry level (Jankowicz, 2000). Obtaining the views of a few seafarers selected at random may not be representative of the entire population (Gay, 1992).

3.1.1.2 Data Collection Instruments

The number of instruments necessary to address adequately the issues raised was also a matter that required some consideration. As the primary focus of this thesis was on the organisational culture of a ship, two instruments were deemed necessary as, the literature suggested, the different stages of culture required a different approach to obtain the desired information. For example, the best suggested way to determine the 'Assumptions' of seafarers was by the use of metaphorical imagery (Krefting & Frost, 1985). The construction of this instrument is described in Section 3.1.1.2.3. For determining the 'Observable Behaviour' and 'Values' of seafarers a direct questioning approach was used (Schein, 1985). The construction of this instrument is described in Section 3.1.1.2.1. As organisational climate involves different issues from that of the broader organisational culture a third validated instrument was used (Moos, 1974). A description containing the methodology chosen and the construction of the instrument is contained in sections 3.1.1.2.11, 3.1.1.2.12.

Methodology for Research Question 1: ***How does a ship's crew perceive its organisational culture?***

The purpose of this Research Question was to describe and understand the organisational culture on board a ship. Organisational culture, for investigation in this study, comprises of three stages, which are the 'Observable Behaviour' of a seafarer (Stage One), seafarer 'Values' (Stage Two), and their 'Assumptions' (Stage Three).

In the evolution of an organisation's culture these three stages do not develop concurrently (see Sections 2.1.1.2., 2.1.1.3, 2.1.1.4). As will be recalled from the Literature Review, during the first stage, the 'Observable

Behaviour' of organisational members develop. In Stage Two, which is the intermediate stage between the superficial and sub-conscious aspects of a culture, the 'Values' of an organisation develop. Stage Three is the area where the 'invisible' issues that guide an organisation reside; it is in this stage that the 'Assumptions' held by organisation members develop (Schein, 1985). The first two stages of a culture are held within the conscious minds of seafarers and may therefore be ascertained by questions that directly address the issues (Gay, 1992). The third stage or the assumptions held by seafarers however are held in the subconscious of a person, as they are issues that are rarely consciously thought about (Schein, 1985). In the third stage the best method of ascertaining these assumptions was to use an instrument that uses metaphorical imagery (Krefting & Frost, 1985).

It is readily apparent from the above brief description that using a common approach to obtain information for all three stages of a culture was not appropriate. Two instruments were therefore constructed, the Maritime Culture Questionnaire (MCQ), which used the direct questioning method to obtain information on the 'Observable Behaviour', and the 'Values' of seafarers. The second instrument was the Assumptions through Metaphor (AtM), which used metaphorical imagery to obtain information on the assumptions held by seafarers.

The aim of the MCQ instrument was twofold: first, to gain an understanding of the above described aspects of organisational culture; second, to determine if any linkages existed between maritime accidents and organisational culture. The two stages of the organisational culture of a ship that this instrument examined were the `Observable behaviours' and `Values' of seafarers; these formed sub-question one and two of Research Question 1. The issues that each sub-question addressed were:

'What observable behaviours do seafarers display when working aboard ship?' and

'What do seafarers value about their working environment?'

The AtM instrument was utilised to determine the 'Assumptions' held by seafarers, which formed sub-question three of Research Question 1. The stage of culture addressed by this instrument was:

'What assumptions guide the actions of seafarers?'

3.1.1.2.1 Description of the Instruments used in Research Question 1

The Maritime Culture Questionnaire (MCQ) (See Appendix 7) was the first instrument in a suite of two. It consisted of three parts; the first was a series of questions, known as 'outcome variables', designed to obtain general information about the last ship on which the seafarer had sailed. A correlational analysis assisted in determining if any linkage existed between these outcome variables and the other items in the MCQ. The second part of the instrument, labelled the 'Observable Behaviour Section', consisted of items designed to obtain information on the 'Observable Behaviour' of seafarers. The third part labelled the 'Values Section', was designed to determine the 'Values' held by seafarers.

There were six items in the sections `Observable Behaviour' and `Values' and these six items were grouped according to human behaviour displayed by organisational members of the three organisational categories proposed by Bennis & Nanus (1985) (i.e., Formalistic, Collegial and Personalistic). There were thus two items in each section that described the behavioural pattern of organisational members for each organisation type. The two descriptors of each item were alternately positively and then negatively worded in accordance with the principles of good instrument design (de Vaus, 1986).

An example of a positively worded item that described behaviour in a formalistic organisation was:

- The ship was very organised and the heads of department supervised each aspect of the ship's work closely. They did this to help people do their jobs well and improve crew morale.

A negatively worded item for the same type of organisation read:

- Duties were highly structured with everything set out explicitly. Deviations from laid down procedures were frowned upon and the person concerned penalised.

Each item was scored on a five-point Likert scale (de Vaus, 1986). The scale ranged from 'Strongly Disagree' (**SA**) to 'Strongly Agree' (**SD**). Items 1 and 6, were worded so as to describe a 'Formalistic' organisation. Items 2 and 4 described a 'Personalistic' organisation, whilst items 3 and 5 described a 'Collegial' organisation. In the positively worded statement 'Strongly Disagree' was scored with 1 and 'Strongly Agree' was scored with 5. In the negatively worded item the scores were reversed in order to obtain uniform scores for the analysis (de Vaus, 1986).

In the 'Values' section, items 1 and 6 described the values held by members of a 'Formalistic' organisation. Items 4 and 5 by members of a 'Personalistic' organisation, and items 2 and 3 those for a 'Collegial' organisation. The alternate positive and negative wording of the items was maintained in this section as well.

A positively worded item describing the values held by members of a collegial organisation read:

- Members of the ship valued their Head of Department's efforts to seek their opinions in order to run the department efficiently.

A negatively worded item for the same organisation reads:

- Most members thought that the demonstrations provided by the Head of Department were of little or no value, as thereafter the same person would constantly criticise and demean them when they did the same job.

3.1.1.2.2 Validation of the MCQ Instrument.

The MCQ was applied to a pilot sample of 26 seafarers who were studying at the Australian Maritime College, Launceston, Australia.

The responses in the pilot sample were subjected to an internal consistency and reliability analysis (Gay, 1992). The analysis showed that the responses did not produce a satisfactory reliability figure (Cronbach alpha). In an attempt to discover the reason for the appearance of low internal consistency reliability figures, the items were re-studied. It became apparent that the respondents could have interpreted the items differently. To determine whether this was the case parts two and three of the MCQ instrument was subjected to a Principal Components and Factor Analysis (Statview, 1992). The Principal Components analysis is a classical technique which is appropriate when the dataset represents a random sample of observations and the variables within the dataset are fairly complete and represent issues relevant to the objectives to the study (Statview, 1992). This analysis method is used for data reduction and it seeks the underlying dimensions that account for patterns of variation among observed variables. The underlying dimensions imply ways to combine variables and thus simplify subsequent analysis (Hamilton, 1992).

The analysis rearranged the original groupings into new clusters according to the behaviour displayed by the Head of Department (HOD). It also showed that seafarers did not differentiate between their actions and that of the HOD. As the focus of the study was on the behaviour and interaction amongst seafarers, which group also comprised the HODs, it was decided to administer the instruments without changing them, but use the Principal Components and Factor Analysis to analyse the responses (Hamilton, 1992).

3.1.1.2.3 Construction of the Assumptions through Metaphors (AtM) instrument.

The 'Assumptions through Metaphor' instrument (AtM) (see Appendix 5) was the second instrument in the suite of two. This instrument is an abbreviated version of the 'Images of School through Metaphor – Actual' (ISMA) instrument designed by Grady, Fisher & Fraser (1996). Its purpose was to explore the hidden assumptions and unconscious value systems that guide the actions and behaviour of seafarers. These assumptions were the unseen signposts that seafarers used to guide their day-to-day activities and form the bases that justify the attitudes and actions of seafarers (Schein, 1985). To determine these assumptions required a different, more careful and systematic approach. Sergiovanni (1987) stated that metaphors are the most effective means to determine deeply held assumptions. Though they are not literal descriptions of reality, their power and strength lies in directing a person's thinking in a particular direction, to sharpen the meaning of a word or concept.

The principles used in the development of the AtM are the same as those used by Grady, Fisher & Fraser (1996), who developed two instruments called 'Images of School through Metaphor – Actual' (ISMA) and 'Images of School through Metaphor – Ideal' (ISMI). School leaders and researchers who wished to survey the images that teachers had of their school might use the above two instruments. Boulding (1956) earlier suggested that this method is appropriate when people's images of the world were to be de-constructed from the language they used and the messages they transmitted. The ISM instruments (Actual and Ideal) drew on this power to assist leaders gain insights into teachers' images of a school and therefore into aspects of their behaviour. The AtM was designed with a similar objective.

The Actual Form (ISMA), on which the AtM is based, focused on teachers' images of school or an aspect of it as it existed. The questionnaire consisted of 26 metaphors. Teachers were invited to indicate the extent to which each metaphor accurately described their school or an aspect of it. The 'Actual' form asked teachers to describe a school as it actually was. The 'Ideal' form however asked teachers to indicate what kind of place they would like a school to be. The 'AtM' asked seafarers to link their image of shipboard life with the metaphors supplied by the instrument.

The AtM however had less metaphors listed than the ISMA and this decision was taken as the MCQ had 10 outcome variables plus 12 items in sections 2 and 3, while the AtM had 12 items. These two instruments comprised 36 items in total. In addition, the third instrument, the Maritime Climate Questionnaire (MClQ), had 44 items. As all three instruments were being applied simultaneously to respondents, the length of each instrument became an issue that required to be addressed. It also was felt that certain metaphors such as , amongst others, 'artist's palette' and 'traffic jam' were not appropriate for a maritime work setting.

The AtM also differed from the ISM in another way. It not only set out to ascertain seafarers' assumptions when they were working aboard a ship, but also the assumptions they had regarding their Heads of Department (HOD). The first eight items provided metaphors that symbolised life aboard a ship. The last four items provided metaphors that symbolised a respondent's assumptions about the Heads of Department. An example of an item for life aboard ships is:

- Ships and life aboard them are Military Camps.

While for assumptions regarding shipboard leaders:

- Heads of Department aboard ships are Expeditionists.

Each question had two parts, the first was a statement suggesting a metaphor that symbolised either life aboard ship, or a description of the Head of Department (HOD). The second part consisted of two statements that suggested a definition for the metaphor. This was done in an attempt to obtain a uniform definition. One statement was worded positively while the other was worded negatively. After these two statements a space was left blank for the respondent to provide a definition, in case the definitions provided did not adequately fit the description that the respondent had in mind.

The first part was scored on a five-point Likert scale, ranging from 'Strongly Agree' to 'Strongly Disagree'. In the positively worded statement ‘Strongly Agree’ was scored with 1 and ‘Strongly Disagree’ was scored with 5. In the negatively worded item the scores were reversed in order to obtain uniform scores for the analysis.

In order to validate a metaphor for use in the analysis Grady, Fisher & Fraser (1996, p.44) stipulated that they must have:

- a high level of agreement (at least 70%) between respondents concerning the image they had in mind when they indicated that their school (read ship) was or was not depicted by the metaphor.

This was interpreted to mean either of the two scenarios:

- 70% of the respondents ‘Agree’ or ‘Strongly Agree’ that the metaphor represented ships and life aboard them or their HODs. This aspect was labelled Criterion One in the Validation Table for each metaphor. (See Appendix 6, Table 41 for an example of such a Table)

Or

- 70% of the respondents ‘Disagree’ or ‘Strongly Disagree’ that the metaphor represented ships and life aboard them or their HODs. This aspect was labelled Criterion Two in the Validation Table for each metaphor.

Criterion Three addressed the second part of the ‘images’ requirement stipulated by Grady, Fisher & Fraser (1996), i.e., whichever criterion had the majority of responses was further analysed to assess the number of respondents that attached the same meaning to the metaphor. If a positive definition was chosen then (1) was inserted after the Figure in Criterion Three. If a negative definition was chosen then (2) was inserted.

The remaining criteria specified by Grady, Fisher & Fraser (1996, p.44) were that each metaphor must:

- Attract relatively few neutral/unsure responses (less then 30%). This aspect was labelled Criterion Four, in the Validation Table.

and

- Yield responses on at-least four of the five points of the scale, given the variety of backgrounds and situations of the group (Grady, Fisher & Fraser, 1996, p.44). (This aspect is known as Criterion Five in the Validation Table.)

3.1.1.2.4 Validation of the AtM Instrument

Each ISM instrument contained 26 individual items and used a factor analysis, (oblique solution primary pattern matrix employing the orthotran algorithm) to cluster the items into related groups (Grady, Fisher & Fraser, 1996). The criterion applied was that an item must load at least 0.40 on a single factor and less than 0.40 on all other factors (The AtM used the same criterion). The responses from the pilot sample showed similar results (see Appendix 6, Table 52, 53).

Methodology for Research Question 2: ***Does a common organisational culture exist on all ships?***

The purpose of this Research Question was twofold: first, to determine whether or not a single homogenous maritime culture existed globally? Or, did the industry have many different maritime cultures that were generally split according to flag state lines? This question was relevant as the seafaring sector of the maritime industry was not only multi-organisational but multi-national as well. Such an issue was important as it needed to be tested whether or not multiple maritime cultures existed.

The second purpose of the Research Question was to investigate whether or not any sub-cultures existed on board a ship. The working environment of the functional departments aboard a ship (Navigation, Engineering, Catering, etc.) had many conditions that could encourage the formation of a sub-culture (see Section 2.1.2.2). The existence of sub-cultures, if they did exist, also had safety implications for the maritime industry. For example, conflict between two sub-cultures especially when members of each sub-culture had to work together could have adverse safety implications for the ship.

3.1.1.2.5 Description of the Instruments used in Research Question 2

The instrument used to address this Research Question was the Maritime Culture Questionnaire (MCQ) (See Appendix 7). The following section describes the construction of the instrument and a succeeding section explains how the data was validated and analysed.

3.1.1.2.6 Construction of the Instrument

Part 1 of the Maritime Culture Questionnaire (MCQ) instrument contains the two outcome variables that deal with these issues, namely:

- Nationality of your last ship.
- To which department do you belong Deck Officer / Engineering Officer / Rating.

Part 2 of the instrument contained items designed to investigate the 'Observable Behaviour' and Part 3 the 'Values' displayed by seafarers. As 'Observable Behaviour' and the 'Values' were the more superficial levels of a culture, they are also the areas where a divergence of cultures would become more readily apparent. A correlational analysis (Statview, 1992) therefore, between items in Part 1, Part 2 and Part 3 addressed the issues raised by the Research Question.

3.1.1.2.7 Validation of the Instrument

The strength of the correlation and the probability of its occurrence indicated the validity of a relationship between the outcome variables and the responses in part 2 and 3 of the MCQ instrument (Statview, 1992). The issues dealing with the validation of the document were dealt with in section 3.1.1.2.2.

Methodology for Research Question 3: ***What is the relationship between human error and maritime accidents?***

The purpose of this Research Question was to determine whether any aspect of a seafarer's behaviour could be linked statistically to a maritime accident. These outcome variables have been cited by some accident investigations as one of the causes of a maritime accident. For example section 1.1.1.5 in Chapter One described the possible adverse impact that the reduction of seafarers working on board ship may have had on the safety of the ship. As was seen from the Literature Review no published study had yet attempted to validate that specific claim and the insertion of the outcome variable in this section attempted such a validation.

3.1.1.2.8 Description of the Instruments used in Research Question 3

The outcome variables were inserted in first part of the MCQ document (See Appendix 7), which is the same instrument used to address Research Question 1.

Literature reviewed in Chapter 2 identified a linkage between the following outcome variables and maritime accidents: 'size of a ship', 'number of person's working aboard a ship', 'time spent aboard a vessel', 'the amount of time normally spent aboard a ship', 'a seafarer's impression of the general motivational characteristics of their job', and 'the type of accident' if any had occurred. Section 1.1.1.6 outlined the circumstances that have caused these outcome variables to be cited as causes of maritime accidents. The literature review was unable to locate any published study that validated these claims and the insertion of these outcome variables was designed to test the following sub-questions:

- Is there a statistically significant difference in the rate of occurrence of accidents between different sizes of ship?
- Is there a statistically significant difference in the rate of occurrence of accidents between ships of different flag-states?

- Is there a statistically significant difference in the rate of occurrence of accidents between different departments working aboard a ship?
- Is there a statistically significant difference in the rate of occurrence of accidents between ships having different crew sizes?
- Is there a statistically significant difference in the rate of occurrence of accidents when correlated with the time-period a seafarer spends aboard ship?

3.1.1.2.9 Analysis of the Instrument

A correlational analysis between items in Part 1, Part 2 and Part 3 addressed the issues raised by this Research Question.

3.1.1.2.10 Validation of the Instrument

The issues dealing with the validation of the document were dealt with in section 3.1.1.2.2 of this chapter.

Methodology for Research Question 4: ***How does a ship's crew perceive its organisational climate?***

The goal of this Research Question was to describe the maritime climate that seafarers reported they experienced when they worked on board a ship. The purpose of this Research Question was to determine the common factors on board a ship that existed on all ships, regardless of the operational differences between companies and flag states. The instrument designed for the purpose is the Maritime Climate Questionnaire (MClQ) (see Appendix 8.)

3.1.1.2.11 Description of the instrument used to address Research Question 4

This instrument the Maritime Climate Questionnaire (MClQ), was designed to investigate conditions aboard a ship. The instrument is a direct derivation from Moos' (1986) Workplace Environment Scale (WES).

Table 8. WES social climate dimensions.

Type of Environment (Scale)	Relationship Dimension	Personal Growth Dimension	System Maintenance & Change Dimension
Work Milieus Scale(WES)	Involvement, Peer cohesion, Supervisor support Expressiveness	Autonomy, Task orientation, Work pressure	Clarity, Control, Innovation, Physical comfort.

(Moos, 1986)

The WES scale is a variant of the Classroom Environment Scale (CES) developed by Moos (1986). Both of Moos' instruments were designed to measure the psychological as well as social dimensions of an environment. In the original design Moos developed the instrument to reflect two different viewpoints. The first was that of an 'insider' and the second perspective that of an 'outsider'. Moos' instrument categorised items into three dimensions, namely: 'Relationship', 'Personal Growth', and 'System Maintenance and Change' that were then used in the analysis.

3.1.1.2.12 Construction of the Maritime Climate Questionnaire (MClQ)

Moos concluded from his studies that all three categories must be assessed if a reasonably complete picture of any environment was desired. Table 8 lists the aspects being investigated in each dimension utilising the WES.

Table 9. MClQ Relationship Dimension.

Scale	Items
Involvement	1, 12, 23 (negatively worded), 34
Peer cohesion	3, 14, 25 (negatively worded), 36
Supervisor support	2, 13, 24 (negatively worded), 35
Expressiveness	4 (negatively worded), 15, 26, 37

The MClQ had a total of 44 items, which were divided into four groups that each contained 11 items. The phraseology used for each item described an element of a dimension and is listed in Table 8 under the related dimension. This phraseology is varied four times -- one for each of the groups described above. The phraseology in three of the elements was positive while it was negative in one element. Table 9 lists the elements under the Relationship dimension and lists the relevant item numbers that referred to the element in each of the four groups.

Similarly Table 10 (Personal Growth Dimension) and Table 11 (System Maintenance and Change Dimension) list each component element and their related item numbers in the instrument.

Table 10. MClQ Personal Growth Dimension.

Scale	Items
Autonomy	5, 16, 27 (negatively worded), 38
Work pressure	11, 22, 33 (negatively worded), 44
Task orientation	6, 17, 28 (negatively worded), 39

This instrument was scored on a five-point Likert-scale (de Vaus, 1986) from 'Strongly Disagree' to 'Strongly Agree'.' Strongly Disagree' was scored with 1 while 'Strongly Agree' was scored with 5. In the negatively worded items the scores were reversed to obtain uniform scores for the analysis (de Vaus, 1986).

Table 11. MClQ SM & CD Dimension.

Scale	Items
Clarity	8, 19, 30 (negatively worded), 41
Staff supervision	7, 18, 29 (negatively worded), 40
Innovation	9, 20, 31 (negatively worded), 42
Physical comfort	10, 21 (negatively worded), 32, 43

3.1.1.2.13 Validation of the Instrument and comparison with other studies

The pilot sample was subjected to an internal consistency and reliability analysis (Gay, 1992). This analysis was compared with other similar studies that had used this instrument (See Appendix 9, Table 55).

A review of these figures revealed that some groups had very low internal consistency and reliability values and these values were low even when compared with studies carried out by other researchers (See Work Pressure in Appendix 9, Table 55). A reason for this could be that the earlier studies were carried out on members belonging to a single culture. The current study however involved a more culturally diverse population, which may explain the lower than expected values in some components. Each scale was composed of four items that were used both in the correlation as well as Internal consistency Reliability analyses. In studying the correlations of each scale it was noticed that certain items had low correlation values with respect to the other component items of the same group. In an attempt to obtain higher correlations and Internal consistency and Reliability values these items were eliminated and revised values obtained.

In some cases the correlation of more than one item was non-statistically significant. These items were then eliminated to test its effect on the internal consistency reliability of the group. Using such a procedure the highest possible internal consistency reliability values were obtained (See Table 51).

In an effort use the data more efficiently the instrument was subjected to a Principal Components and Factor Analysis (Statview, 1992). This analysis method is used for data reduction and it seeks the underlying dimensions that account for patterns of variation among observed variables. These underlying dimensions imply ways to combine variables and thus simplify subsequent analysis (Hamilton, 1992).

This analysis arranged the seafarer's responses into dimensions that were similar to those originally proposed by Moos (1986) (See Appendix 9, Table 96). As this method produced a statistically valid outcome (See Appendix 9, Tables 74 – 83 for the complete analysis) (Statview, 1992), the study used the Principal Components and Factor analysis for analysing the responses.

3.1.2 Ethics procedures followed by the study

Once the instruments were completed an application was made to the Social Science Human Research Committee for ethics clearance. The documentation provided by the University indicated that a minimal risk form (See Appendix 10) would be required. The duly completed form (See Appendix 10) was submitted along with a document summarising the study (See Appendix 11) as well as the six instruments (Three in English (Appendices 5,7 &8) and Three in German) (Appendices 12 to 14) and a Participant Information sheet (see Appendix 4), as supporting documentation. On obtaining ethics clearance the instruments were applied to respondents.

3.1.3 Description of subjects in the survey sample

The original intention was to apply the three instruments as broadly as possible across the whole spectrum of seafarers. It was however difficult to directly target or approach people working on board ships. Most ships spend relatively little time in port. Ships only come to port to load or unload cargo, to take on fuel or bunkers, to dry-dock or for emergencies. Current management practices described in Chapter One try and minimise the port stay of a vessel to contain operational costs.

Also the busiest time in the operational cycle of a ship occurs when a vessel was in port. At this extremely busy time the motivation for filling in forms or survey questionnaires would be low.

The most effective method therefore would be to use training institutes as platforms for applying the instruments. This however has a disadvantage, as not many Ratings would have the opportunity to respond. The training that Ratings receive generally occurred at the beginning of their careers and before they commenced work aboard a ship. Thereafter the industry does not require them to periodically retrain nor do short courses to keep their skills current.

The Research Questions addressed by the survey may make it difficult for people who have not worked at sea to respond accurately to them. For example, there were many people at a Nautical Training Institute who were training to go to sea as Navigators, Engineers or Ratings. The study's goal was to determine the nature of Organisational Culture as well as Climate and the responses sought therefore were the descriptions from people who had already worked on board ships. People who had not worked aboard a ship may not have an accurate practical based perception of shipboard life, i.e., their impressions may not be completely accurate or full, these people, therefore, did not participate in the survey. Only persons, who were doing their certificate of competency examination at the training institute, fulfilled the criteria of being seafarers with seagoing experience. Also the training institutes of the UK and Australia had seafarers from many other countries studying there, and many of these students had worked on 'flag of convenience' vessels.

Table 12. Response breakdown by Institution.

Institution	Instrument		
	MCQ	AtM	MClQ
Australian Maritime College	195	205	164
Fleetwood Nautical College	109	111	112
Glasgow Nautical College	33	27	32
South Shields Nautical College	81	80	79
T.S. Rahaman, Bombay	39	40	39
LBS CAMSAR, Bombay	60	60	61
Fachbereich Seefahrt, Warnemünde	10	11	9
Danish Maritime Academy, Fanöe	4	4	4
Nautical Institute	10	11	10
Warsash Maritime Centre	48	41	50
Singapore Polytechnic	30	28	30
Magsaysay Shipping Institute	38	38	38
Akademi Laut Malaysia	82	82	82
Total	739	738	710

A second means to contact active seafarers was to use the Nautical Institute as the platform for distribution of the instruments to its members. The Nautical Institute has 38 branches around the world and has between 7000 and 8000 members and its membership consists of people working in the maritime industry. In addition the membership is restricted to maritime professionals therefore effectively ruling out Ratings. The Nautical Institute mailed out the suite of instruments to every member and requested a response in their magazine 'Seaways'. A return address was provided, it was not possible to provide a stamped return envelope, as the members of the institute come from many countries. Ten completed responses, a response rate of 0.1%, were received using this method.

The preferred and main method of application was to approach the administrations of various nautical institutes, apprise them of the study and request their cooperation. Once an institution agreed to participate in the study, a date was set for the application to take place. It was in essence a large 'Opportunity' sample (Gay, 1992).

The Australian Maritime College purchased a marine simulator from STN Atlas Gmbh in Bremen, Germany. Part of the terms for delivery of the system was that three lecturers from the Australian Maritime College were to be trained in its operation. The researcher was selected as one of the persons who would go to Germany to be trained in the use of the simulator. This presented an opportunity to apply the survey instruments to students at the various training institutes in the UK and Germany. The route configuration devised by the travel agency permitted a stopover in the cities of Bombay on the way out to Germany and Singapore on the way back to Australia.

As a result of the flexible travel plans arrangements were made to distribute the questionnaires at the following institutions:

- Blackpool & The Fylde College, Fleetwood Nautical campus, U.K.
- Fachbereich Seefahrt, Warnemünde, Germany

- Glasgow College of Nautical Studies, Glasgow, Scotland, U.K.
- Lal Bahadur Shastri College of Advanced Maritime Studies and Research, Bombay, India
- Singapore Polytechnic, Singapore
- South Tyneside College, Southshields, U.K.
- Training Ship 'Rahaman', Bombay, India
- Warsash Maritime Centre, Warsash, U.K.

Table 13. Rates of return from the Institutes where the Instruments were distributed.

Institution	Percentage rate of return
Nautical Institute	0.1%
Danish Maritime Academy	100%
Fachbereich Seefahrt, Warnemünde	100%
Blackpool & The Fylde College	100%
Glasgow College of Nautical Studies	100%
South Tyneside College	100%
Singapore Polytechnic	30%
Lal Bahadur Shastri College of Advanced Maritime Studies and Research	60%
Training Ship 'Rahaman'	100%
Warsash Maritime Centre	100%
Akademi Laut Malaysia	100%
Magsaysay Shipping Institute	100%

An opportunity to distribute the questionnaires in the Philippines and Malaysia arose at a later date. The questionnaires were then distributed at the following institutes:

- Magsaysay Shipping Institute, Manila, Philippines
- Akademi Laut Malaysia, Melaka, Malaysia

The rate of return from each of the institutions is shown in Table 13. The respondents were primarily students studying for various Certificates of

Competency at the institutions listed and typically they were Officers and Engineers who had worked at sea.

There were however a small component of 'non-students' in the Nautical Institute and Danish Maritime Academy sample. This Danish Maritime Academy sample consisted of seafarers attending a medical course for sailors, while the respondents from the Nautical Institute were mainly master mariners.

3.1.3.1 Translation of Instruments into German

In 1997 a naval architect student (Ms H Cramer) from the Hamburg Polytechnic, Germany won a scholarship to study naval architecture at the Australian Maritime College, Launceston, for a year. It was felt she would be a suitable translator as she was fluent in both English and German. As a student of naval architecture she would also be familiar with nautical terminology; as a result of the above she was approached to translate the instruments into German. The first questionnaire to be translated was the MCQ.

The proof-reading processes were completed by a lecturer at the AMC, who read the MCQ; a staff member of STN Atlas Elektronik, Bremen, read the AtM; and another staff member of STN Atlas Elektronik, Bremen read both the AtM and the MClQ. Some alterations were made to make the questionnaire more culturally attuned. As the questionnaires were identical to the English ones, they were scored in the same way. (A copy of each translated document is shown in Appendix 12, Appendix 13 and Appendix 14, respectively.)

3.1.4 The study time-line

The initial gathering of information for the thesis commenced in early 1996. At this time the development of Instruments was also commenced when the trip to Germany was confirmed. The pilot for all three questionnaires was distributed to the members of the academic staff of the

AMC and the instruments were then modified prior to departure for Europe.

Table 14. The Study Time-line.

Activity	1996	1997	1998	1999	2000	2001	2002	2003	2004
Historical review									
Commence Literature review									
Develop Methodology									
Develop and validate Instruments									
Distribute Instruments									
Collate information from Instruments									
Analysis of Survey Data									
Write up of Chapters									
Write up document for presentation for examination									

After the initial distribution in Europe and India, the instruments were distributed in the AMC throughout 1997, 1998 and during 1999. This period was also spent waiting for the returned instruments from the Warsash Maritime Centre, The Nautical Institute, Fachbereich Seefahrt, Warnemünde, The Danish Maritime Academy and Singapore Polytechnic. The data were collated as soon as the instruments were completed and returned. Analysis of the completed database was commenced in 2000 and completed in 2001. This prolonged period of analysis reflected the difficulty experienced to effectively analyse the contents of the database.

3.1.4.1 Analysis of Data

The validation procedures carried out on the samples showed that three main methods would be used to analyse the data. The main method of analysis chosen, as it produced statistically valid and reliable data, was the Principal Components and Factor Analysis (Hamilton, 1992). The Principal Components and Factor Analysis is a classical technique appropriate when a dataset represents a random sample of observations, which is an appropriate description for the sample used in this study; and the variables chosen were a fairly complete collection of the issues that were of interest to this study (Statview, 1992). This method was used to describe the Organisational Culture and Organisational Climate. The analysis of the outcome variables was carried out by a correlational as well as a logistic regression analysis, as such an analysis is used to examine relationships within the data (Statview, 1992) between the outcome variables and the responses of the seafarers to the MCQ instrument.

The analysis of the AtM instrument was carried out using the procedures specified by Grady, Fisher & Fraser (1996), which were described in detail in section 3.1.1.2.4.

3.1.5 Summary of Chapter

This Chapter has discussed the research design and validation procedures appropriate for the study. The research design chosen was one that attempted to explore the subjective experiences of seafarers and use these experiences to describe Organisational Culture and Climate of a ship and investigate the linkages between these and maritime accidents. It has documented the processes that were used in selecting the participants and the process followed to gain permission from the Social Science Human

Research Committee for ethics clearance prior to the application of the instruments. The research method chosen was essentially a combination of the qualitative and quantitative approaches and used the application of three instruments at 12 maritime training institutes, in seven countries and the Nautical Institute, which is a seafarer professional organisation.

The first two of the three instruments used to address the Research Questions were the Maritime Culture Questionnaire (MCQ) and the Assumptions through Metaphor (AtM). The responses to these two instruments assisted in the description and understanding of Organisational Culture on board ship. The MCQ served a further purpose as it contained outcome variables, which were used to explore the linkages between the Organisational Culture and maritime accidents.

The Maritime Climate Questionnaire (MClQ) was the third instrument used in the study. The responses to this instrument assisted in the description of Organisational Climate on board ships.

The instruments used by the study were developed using techniques developed by researchers in cognate areas, such as Education. The validation process for each instrument was described in this chapter.

The following chapter, Chapter Four, presents results of the analysis on the data collected using the three instruments.

Chapter. 4

Results

This chapter presents the data and results obtained from the analyses of the three research instruments. The results are presented in four main sections corresponding to the four Research Questions. The relationship the data had with each Research Question determined the order of presentation.

4.1.1 Research Question 1: How does a ship's crew perceive its organisational culture?

This section reports the findings obtained after the Maritime Culture Questionnaire (MCQ) and the Assumptions through Metaphor (AtM) instruments were analysed.

These two instruments were applied to respondents and their responses were compiled into two databases; one for the MCQ instrument and the other for the AtM instrument. As described in Chapter 3 the MCQ consisted of three parts; the first consisted of outcome variables, the second, items relating the 'Observable Behaviour' of seafarers and, part three, items relating to the 'Values' of seafarers.

The results described in this section have been obtained after analysing the MCQ database and the AtM database.

4.1.1.1 Findings obtained from an analysis of the responses to the MCQ

The MCQ was analysed using the Principal Components and Factor analysis (Hamilton, 1992). On completion of the identification of factors that formed each cluster a correlational as well as a linear regression analysis was conducted between each item in the instrument and the raw data on accidents. This was done to assess whether or not there was any link between the behaviour patterns of HODs and maritime accidents.

Only relevant Tables that directly supported the findings of this study are presented in this section. Appendix 15 contains full details of the analyses.

4.1.1.1.1 Findings from the Observable Behaviour Section of the MCQ

The results described in this section were obtained after analysis of the MCQ database. The analysis referred to in this section is the Principal Components and Factor Analysis (Hamilton, 1992); the clusters described below were arrived at using this method. A linear regression analysis was then conducted on the factors to discern any relationships that may be contained in the dataset.

Table 15. Rotated Component Matrix (HOD Observable Behaviour Section).

Item	Cluster 1 Collegial Behaviour	Cluster 2 Formalistic behaviour
OB 1	.778	.065
OB 2	.110	.604
OB 3	.785	-.101
OB 4	-.002	.732
OB 5	.745	-.007
OB 6	-.164	.649

The factor analysis showed that more than 50% of the total variance in the 'Observable Behaviour' (OB) variables was explained by two underlying factors, which were themselves un-related. As the analysis congregated all the items into two groups or clusters, for the convenience of this thesis, each grouping is hereafter referred to as a cluster.

The first cluster was expressed through items 1, 3 and 5 and labelled the 'HOD Collegial behaviour' cluster (see Table 15). The label was thought to be the most appropriate after reading the contents of each clustered item. The second cluster was expressed through the items 2, 4 and 6 to form the 'HOD Formalistic behaviour' cluster. This label was thought to be the most appropriate, after reading the contents of each clustered item (see Table 15).

Table 16. Descriptive statistics (Observable Behaviour section). (After item extraction using the Principal Components and Factor analysis).

1. Collegial behaviour section	Median	Mode	Mean	SD
HOD Collegial behaviour cluster	**4**	**4**	**3.5**	**1.115**
(1) The ship was very organised and the heads of department supervised each aspect of the ship's work closely. They did this to help people do their jobs well and improve crew morale.	4	4	3.7	1.009
(3) The heads of department met frequently with all members of their department to discuss problems and to praise members who had done well.	4	4	3.3	1.189
(5) The head of department usually demonstrated by personal example how things were to be done, but generally encouraged discussion and criticism of the procedures.	4	4	3.4	1.097
HOD Formalistic behaviour cluster	**3**	**4**	**3.1**	**1.065**
(2) Ideas about the work to be done were discussed frequently within the department but solutions that did not concur with those proposed by the head of department were not accepted.	3	2	2.9	1.032
(4) People learned what to do by imitating the behaviour of the head of department. They also learned from non-verbal signals by them that discussion and criticism was frowned upon.	3	2	3.0	1.051
(6)Duties were highly structured with everything set out explicitly. Deviation from the laid down procedures were frowned upon and the person concerned penalised.	3	2	1.1	1.100
Key: (1) Clusters are as identified by the Principal Components and Factor analysis. (2) Numbers in brackets indicate the original numbering as displayed in the instrument. (3) The values displayed alongside each cluster label are the mean values of all the component items that form the cluster				

A further loglogistic regression (see Table 17) test carried out on individual items in this sample indicated the following results:

Where Observable Behaviour item 1 (OB1) increased there was a lower probability (-β, -.251) of an accident occurring. Thus when a HOD showed a lot of attention to subordinate activities and was supportive of them the accident rate decreased. Where the scores on item 4 (OB4) increased there was a higher probability (+β, .245) of an accident occurring. One can therefore infer that if a HOD did not accept the solutions proposed by subordinates then when an accident occurred seafarers would not report it.

Table 17. Loglogistic Regression analysis of the OB items and V items of the MCQ.

Item	β
OB1	-.251
OB4	.245
V1	-.202
V5	.207

A survival analysis is a suite of statistical techniques used to evaluate data that consisted of the elapsed time between two events of interest. The loglogistic test belongs to this family of parametric statistical methods. It requires two parameters to describe the variables properties and possesses a more flexible hazard function. A hazard function provides an alternative way to convey survival information on a chronological scale (Statview, 1992). β is the regression coefficient and is interpreted as the logarithm of the relative hazard between the two groups. A positive regression coefficient β meant that increases in the covariate Z were associated with increased hazard. Conversely a negative regression coefficient β indicated that increases in Z lead to a lower hazard (Statview, 1992).

It should be noted that although these relationships were statistically significant they were not strongly so. Thus while a trend was evident, the factors indicating the trend were concealed by elements that were yet to be identified.

Table 16 presents the descriptive statistics for the Collegial behaviour items in this group, and these descriptive statistics were used to arrive at the descriptions presented below.

Responses in the 'HOD Collegial behaviour' cluster indicated that when in this mode the HOD acted in a manner designed to improve seafarer efficiency and morale (item 1). Here the HOD frequently met and discussed task relevant issues (item 5) with other department members and praised them when a job was well executed (item 3).

Responses in the 'HOD Formalistic behaviour' cluster indicated that in this mode seafarers were unsure of how a HOD would behave. Seafarers were unsure of the tasks they had to perform as these were not clearly specified. The HOD expected them to know what tasks were to be performed and also expected subordinates not to rely on the HOD to demonstrate task relevant procedures (item 4). If a subordinate provided input on operational procedures, the HOD would give it consideration but would not necessarily adopt it (item 2). The application of penalties by the HOD for deviations by subordinates was erratic (item 6).

4.1.1.1.2 Findings from the Values section of the MCQ

The 'Values' section was also analysed using the Principal Components and Factor Analysis. A logistic regression analysis (Statview, 1992) was then conducted on the factors to discern any relationships that may be contained in the dataset.

The factor analysis showed that more than 60% of the total variance in the 'Values' variables were explained by two underlying factors, henceforth known as clusters. The first cluster is expressed through items 2, 4 and 6 (see Table 18), and was labelled the 'Critical Values' cluster. The label was thought to be the most appropriate after reading the contents of the clustered items. The second cluster was expressed through items 1, 3 and 5 and was labelled the 'Supportive Values' cluster. The label 'Supportive

Values' cluster was thought to be the most appropriate, after reading the contents of the clustered items (see Table 18).

Table 18. Rotated Component Matrix for Values Section.

Item	Cluster 1 Critical Values	Cluster 2 Supportive Values
V1	-.023	.784
V2	.787	.179
V3	.238	.759
V4	.761	.0768
V5	.183	.760
V6	.773	.111

The descriptive statistics for the items in the values section are presented in Table 19. The responses by seafarers in the 'Critical Values' cluster indicated that they felt that many of the meetings conducted by the HOD were futile as the HOD rarely accepted another person's views or suggestions (item 4). The HOD would constantly behave in a negative fashion towards subordinates (item 4) and rarely monitored the proper observance of safety rules by subordinates (item 6).

The responses by seafarers in the 'Supportive Values' cluster indicated that seafarers valued the safety rules and regulations of the industry, as they felt that these rules were for their benefit. They also valued the demonstrations made and the effort expended by a HOD to consult them in the running of the department.

A loglogistic regression test (see Table 17) carried out on individual items in this sample indicated the following results:

Where values item 1 (V 1) increased there was a lower probability (β,-.202) of an accident occurring. Seafarer's valued having task-relevant and safety rules prescribed that governed their working lives aboard ship. The more strongly they held these views the less likely it appeared that an accident would occur.

Table 19. Descriptive Statistics (Values section). (After extraction of items using the Principal Components and Factor Analysis).

Values section	Median	Mode	Mean	SD
Critical Values cluster	**4**	**4**	**3.3**	**1.133**
(2) Most members thought that the demonstrations provided by the head of department were of little or no value, as thereafter the same person would constantly criticise and demean them when they did the same job.	4	4	3.3	1.08
(4) Most members believed that the endless discussions were futile as the head accepted a solution that conformed with that person's pre-arrived at outcome	3	4	3.0	1.04
(6)The members of the department thought that all the rules prescribed by the department were useless as the head never ever bothered to check whether anyone complied with them.	4	4	3.7	1.15
Supportive Values cluster	**4**	**4**	**3.6**	**0.998**
(1) The crew and officers believed that all rules and regulations prescribed on the ship were meant for the good of the ship and benefited them as well.	4	4	3.8	1.08
(3) Members of the ship valued their head of department's efforts to seek their opinions in order to run the department efficiently.	4	4	3.7	0.94
(5) The members thought highly of their head of department as that person not only prescribed a job but also did it as well to show everyone the outcome required.	4	4	3.4	1.04
Key: (1) Clusters are as identified by the Principal Components and Factor Analysis. (2) Numbers in brackets indicate the original numbering as displayed in the instrument. (3) The values displayed alongside each cluster label are the mean values of the of all the component items that form the cluster.				

Where values item 5 (V 5) increased there was a higher probability (β, .207) of an accident occurring. The more a HOD criticised or belittled a seafarer working on the job the more likely it appeared that an accident would occur.

It should be noted that though these were statistically significant findings they were not strongly so. Thus while a trend was evident the factors indicating the trend were concealed by elements that were yet to be identified.

The logistic regression analysis indicated that items in the Collegial Behaviour section were not correlated with the items in the Values section.

Analysis of the 'Observable behaviour' and the 'Values' section indicated that seafarers have to contend with two behaviour patterns displayed by HODs. The first pattern is that of a very supportive person who behaved in a collegial fashion to run the department. The other is a very negative behaviour pattern, where the HOD expected every person to know what they were required to do without any demonstrations and seafarers were allowed a very limited input into the running of the department. The analysis indicated that when the HOD behaved in this negative fashion the accident rate increased and if the HOD behaved in supportive fashion the accident rate decreased. Thus this data show quite clearly the behaviour pattern of the HOD had a direct impact on the safety culture of a ship.

4.1.1.2 Findings obtained from an analysis of the responses to the AtM

The method for evaluating an item in the AtM instrument is described by Grady, Fisher & Fraser (1996). Only items that meet the specified criteria were presented in this section of the Thesis (An analysis of the remaining metaphors is contained in Appendix 6).

Table 20. Validation Table for 'Team' metaphor.

Criterion 1	77.4%	+
Criterion 2	12.2%	+
Criterion 3	67.3% (1)	+
Criterion 4	10.5%	+
Criterion 5	All five categories	+
Key:- # = fails to meet requirements, + = meets requirements		

Table 20 is the validation Table for the item 'Team' and it shows that more than 70% of the sample 'Agrees' or 'Strongly Agrees' it represents life aboard a ship (Criterion 1). Sixty-seven percent agreed that the positively worded definition represented their interpretation of its meaning. Ten and one half percent of the sample were 'Undecided' as to whether or not the term did apply to seafarers and there was a response in all five categories. The metaphor 'Team' thus satisfied all the specified criteria and was retained for analysis.

Seafarers view their working environment aboard as a team effort. The broadly accepted definition by seafarers was that a 'Team' was a collection of seafarers who actively shared ideas or strategies in order to act collectively to achieve a certain goal. This finding supported the results presented in the previous section that seafarers assumed that when they worked on board a ship they were part of a team. Working as part of a team suggests a collegial environment. If a ship was run on lines that did not support a collegial environment then this negatively impacted on the safety culture of the ship.

No other metaphor met the specified criteria. A problem to be acknowledged and overcome with this approach is a possible lack of clarity and common understanding regarding the meaning of the metaphors employed by all the cultures surveyed. It is clearly an area that needs to be studied in greater depth in the future.

The above were the main findings for this Research Question, after analysing the MCQ and AtM instruments.

4.1.2 Research Question 2: Does a common organisational culture exist on all ships?

A correlation and regression analysis between the outcome variables in the MCQ instrument and the items in section 2 and 3 of the same instrument addressed this issue. A correlational value indicates a linear relationship between two variables (Statview, 1992). A regression analysis explains or predicts the value of a dependent variable from one or more independent variables. Here the predictors are the independent variables and they predict the dependent variable (Statview, 1992). The objective of this Research Question was to determine whether or not there was a common organisational culture on all ships and whether or not any sub-cultures existed on ships. Thus this Research Question is addressed in two parts; the first, to examine whether all ships had a single and homogenous organisational culture and, the second, to examine whether or not sub-cultures existed on a ship. The method utilised in this study was to examine the responses of seafarers to determine whether the responses they provided could be used to predict a common maritime culture or sub-culture on a ship. The coefficient used is R squared (R^2) also known as the `coefficient of determination'. This statistic measures the proportion of the dependent variable's variability that is explained by the independent variable. Thus a large R^2, 0.8 indicates that 80% of the dependent variables variation is explained by the independent variable (Statview, 1992).

The relevant Tables containing key data, on which the findings were based, have been presented in this section.

4.1.2.1 Analysis outcomes obtained for Research Question 2

Table 21. Correlation and regression analysis between the 'Nationality' and the 'Collegial behaviour' items.

Variables	Correlation	Count	F-Value	P- Value	R^2
OB1	.022	714	.217	.6417	.0003
OB2	-.024	709	.409	.5226	.001
OB3	-.020	715	.313	.5759	.0004
OB4	-.110	709	8.436	.0038	.012
OB5	-.070	714	3.747	.0533	.005
OB6	-.001	710	.001	.9782	.0000

The first part of the Research Question sought to determine whether or not the culture in the maritime industry was single and homogenous. The study therefore carried out a correlational and regression analysis between the item 'Nationality' and the responses seafarers made in the 'Observable Behaviour' and 'Values' section of the MCQ instrument, to determine whether these responses could be used to predict the country they came from (see Table 21 and Table 22, respectively).

The R^2 and correlations produced by the analyses were low and consequently they could not predict the nationality of a seafarer using that person's responses.

On these data, therefore, the study was unable to predict the nationality of a seafarer from the responses given. This lead to the conclusion that the organisational culture aboard all ships was single and homogenous.

Table 22. Correlation and regression analysis between the 'Nationality' and the 'Values' items.

Variables	Correlation	Count	F-Value	P- Value	R^2
V1	.067	714	2.996	.0839	.004
V2	-.049	712	2.003	.1574	.003
V3	.003	714	.0002	.9873	.0000
V4	-.080	714	4.976	.0260	.007
V5	.079	711	4.021	.0453	.006
V6	-.066	713	3.409	.0653	.005

The second part of the Research Question sought to determine whether or not any sub-cultures existed on a ship. The main areas where sub-cultures could exist on a ship were in the various departments. The study therefore carried out a correlational and regression analysis between the item 'Department' and the responses of seafarers to the 'Observable Behaviour' and 'Values' sections of the MCQ instrument to determine whether these responses could be used to predict the department they came from (see Table 23 and Table 24).

The R^2 and the correlations produced as a result of the analyses were low and consequently they could not be used to predict the department a seafarer came from.

Table 23. Correlation and regression analysis between the 'Department' and the 'Collegial behaviour' items.

Variables	Correlation	Count	F-Value	P- Value	R^2
OB1	.010	636	.059	.8077	.0009
OB2	.041	630	1.051	.3058	.002
OB3	.023	636	.323	.5698	.001
OB4	.036	630	.822	.3649	.001
OB5	.022	635	.285	.5936	.021
OB6	.038	632	.848	.3573	.001

On these data, therefore, the study is unable to predict the department from which a seafarer came using that person's responses. This lead to the conclusion that sub-cultures did not exist on board a ship.

Table 24. Correlation and regression analysis between the 'Department' and the 'Values' items.

Variables	Correlation	Count	F-Value	P- Value	R^2
V1	.008	635	.036	.8505	.00005
V2	.027	634	.444	.5055	.001
V3	.013	636	.104	.7467	.0001
V4	.038	636	.918	.3382	.001
V5	.022	633	.297	.5860	.0004
V6	.011	633	.297	.7887	.0001

4.1.3 Research Question 3: What is the relationship between human error and maritime accidents?

The aim of this Research Question was to explore whether or not any relationship existed between specific outcome variables and maritime accidents. The outcome variables used in the observations were cited by studies described in Chapters 1 and 2. The analysis method chosen was the same as that used by Research Question 2, as the linkages sought by both Research Questions were similar. Thus this Research Question will be addressed in two parts; the first, through a correlation and regression analysis between the items 'nationality' and 'department' and 'accidents'. The second as a correlational and regression analysis between the item 'accidents' and the outcome variables listed in Table 26. The relevant Tables containing key data, on which the findings were based, have been presented in this section.

The outcome variables dealt with in this Research Question were the 'size of the seafarer's last ship', the 'number of people working aboard', the 'time period spent aboard', and the 'occurrence of accidents aboard'.

The correlation and regression analysis between the item 'nationality' and 'accidents' (Table 25) revealed a very small correlation and a small R^2. Thus the nationality of a ship cannot be used to predict an accident.

Table 25. Correlation and regression analysis between number of accidents and the items 'Nationality' and 'Department'.

Variables	Correlation	Count	F-Value	P- Value	R^2
Nationality	-.059	702	2.428	.1196	.003
Department	.217	635	0.00	<.0000	.047

There is a direct correlation between the 'size of a ship' and 'department', and the occurrence of accidents (see Table 26). A simple regression analysis between each category and the occurrence of accidents, however produced a low R^2, both variables' F-value with the accompanying P-value indicated that this F value did not occur by chance. This indicated that both the variables 'ship size' and 'department' explain only a small percentage in the variance of accidents (1% and 4.7%, respectively) they however may not be used as a predictor for the occurrence of an accident.

Table 26. Correlation and regression analysis between number of accidents and the variables 'Department', 'Size of ship', 'Time spent aboard', 'Persons on board'.

Variable	Correlation	Count	F-Value	P- Value	R^2
Size of ship	0.104	615	6.96	.0085	0.010
Department	0.217	635	0.00	<.0001	0.047
Time spent aboard	0.015	615	.837	.3604	0.001
Persons aboard	0.027	615	.526	.4687	0.001

The divergent explanation provided by the correlations and R^2 indicated that there probably was more than a single factor involved in explaining the occurrence of an accident aboard a ship and its relationship with these categories. The instrument used by the study lacked the sophistication to identify the precise factors responsible for the occurrence of accidents and its linkage with the outcome variables discussed.

The study found no relationship between the 'number of persons working aboard ship' and the 'time spent aboard ship' and the occurrence of maritime accidents. They also could not be used as a predictor of accidents (See Table 26).

In conclusion, none of the three factors 'nationality, 'number of persons working aboard' and 'time spent aboard' were correlated with accidents and also could not be used a predictors of accidents. The discussion in Chapter One and the literature reviewed in Chapter Two suggested that it was likely that the time spent on board did impact on the safety culture of a ship. It is likely that there are other factors that also must be present and it is those factors that were masking the relationship. The instrument used therefore lacked the sophistication necessary to discern them.

The items 'Department' and 'Ship size' were directly correlated with accidents, however, there were other larger contributing factors that masked the correlation and the instrument used lacked the sophistication necessary to discern them.

4.1.4 Research Question 4: How does a ship's crew perceive its organisational climate?

To address this Research Question the Maritime Climate questionnaire (MClQ) instrument was analysed using the Principal Components and Factor analysis (Hamilton, 1992). It will be recalled from Chapter Two that climate was described as the working environment in which employees were immersed. Thus where culture dictated the necessary procedures to accomplish a task climate was largely responsible for the state of mind of the person accomplishing it. The goal of this Research Question was to examine how seafarers reacted to their working environment and how these findings impacted on the safety culture of the ship.

4.1.4.1 Analysis outcomes obtained from an analysis of the MClQ Instrument

There are three dimensions in this instrument and the Principal Components and Factor Analysis (Statview, 1992) identified the clusters into which each dimension was split, and the component factors that made up each cluster. Descriptive statistics were then used to describe the factors. The description for each cluster is a synthesis of the responses made by seafarers to each component factor. These descriptions were then compared with those provided by Moos (1974) to determine whether the cluster aligned with them. If a match was obtained the label used by Moos (1974) would be used as the label for the cluster. The description provided by Moos (1974) then follows the label to provide a general description of the cluster. The description that followed the general description was a description of how seafarers discerned the climate for that cluster. The thesis identified three dimensions, 'Relationship', 'Personal Growth' and 'Systems Maintenance and Change' and, these dimensions aligned with those described by Moos (1974).

Only relevant tables that directly supported the findings of this study are presented in this section. Appendix 9 contains full details of the analyses.

4.1.4.1.1 Analysis outcomes obtained for the 'Relationship' Dimension

The `Relationship' dimension contained four clusters. Cluster 1 matched the description of *'Peer cohesion'* (See Table 27) provided by Moos (1974). *Peer cohesion* is the extent to which seafarers operated as a close-knit team that help and support each other.

Table 27. Rotated Component Matrix (Relationship dimension).

Items	Cluster 1	Cluster 2	Cluster 3	Cluster 4
	Peer Cohesion	Involvement	Expressiveness	Staff Support
PC 2	.645	-.192	-.311	.097
PC 3	.596	-.292	.113	-.115
PC 13	.650	-.283	-.291	-.115
PC 14	.529	-.297	-.025	-.186
PC35	.692	-.218	-.173	-.152
PC 36	.590	-.033	.050	-.106
PC 37	.531	-.129	.206	-.161
Item 4	.446	.280	.370	.445
Item 15	.475	.099	.448	-.221
I 1	.267	.567	-.270	-.184
I 12	.442	.553	-.148	-.144
I 34	.311	.592	-.244	-.214
E 26	.344	.140	.687	-.112
SS 24	.461	-.041	-.274	.600
SS 25	.426	.303	.081	.592
Item 23	.101	-.327	.079	.278
Extraction Method: Principal Component Analysis.				
4 components extracted.				

The responses to this category indicated that seafarers and their HODs were largely supportive of each other and they operated as close-knit teams (items 3, 14, 25, and 36). A HOD would generally praise them for a job well done (item 2) but seafarers were not sure of how their opinions would be interpreted if they expressed one (item 37).

Cluster 2 matched the description of *'Involvement'* (See Table 27) provided by Moos (1974). Here *Involvement* is the effort expended by seafarers to achieve good performance outcomes along with the maintenance of high work standards.

The responses to this category indicated that seafarers took great pride in performing and maintaining tasks to high standards.

Cluster 3 matched the description of '*Expressiveness*' (See Table 27) provided by Moos (1974). *Expressiveness* is the extent to which seafarers were able to voice opinions whilst working aboard ship.

The responses to this category indicated that seafarers were unafraid of expressing their opinions freely when they were aboard ship (item 25). It should be noted that there is only one item in this cluster, this aspect would therefore have to be studied further before accepting such a conclusion.

Cluster 4 matched the description of *'Staff support'* provided by Moos (1974). *Staff Support* is the extent to which Heads of Department praised a seafarer for a job well done (item 24). The responses indicated that HODs did not praise or encourage seafarers for a job well done and also that seafarers would not report mistakes if they made any, as they feared the repercussions for reporting such an act (item 25).

In summary, seafarers reported that they operated as closely knit teams that took great pride in their work. Seafarers also contributed their ideas and opinions when invited to do, they however would not report an accident if it remained undetected as they were not sure of how the ensuing repercussions would affect them.

The findings in this section support the findings in Research Question 1, which stated that seafarers preferred working in teams and this is what they assumed would be their workplace environment when they worked on board a ship. The conclusions also revealed one of the reasons why seafarers practised avoidance behaviour, it was the fear of negative repercussions. The reward system of the industry thus had an impact on the safety culture of ships.

4.1.4.1.2 Analysis outcomes obtained for the 'Personal Growth' Dimension

The `Personal Growth' dimension had two clusters (See Table 28). Cluster 1 matched the description of '*Workplace autonomy*' provided by Moos (1974) or the extent to which seafarers were granted autonomy to plan and execute tasks aboard ship.

The responses to this category indicated that seafarers were allowed freedom and autonomy to perform tasks aboard ships. But they were not sure whether the HOD regarded this autonomy as a pre-requisite for efficient ship operations.

Cluster 2 matched the description of '*Task orientation*' provided by Moos (1974) or the extent to which seafarers received guidance in the execution of tasks aboard ship.

Table 28. Rotated component matrix (Personal growth dimension).

Items	Cluster 1	Cluster 2
	Workplace Autonomy	Task Orientation
WA 5	.644	-.155
WA 6	.677	.272
WA 16	.677	-.062
WA 17	.524	.290
WA 38	.523	-.338
WA 39	.598	.269
TO 27	.061	-.698
TO 28	.156	.718
Rotation Method: Varimax with Kaiser Normalisation.		
Rotation converged in 3 iterations.		

The responses to this category indicated that there was no standard way to perform a task on board ship. In addition nobody checked to see if a task was properly accomplished or not.

In summary, seafarers were allowed a large amount of autonomy to perform tasks aboard ship without having a standard procedural method to guide them whilst performing these tasks. When seafarers did complete a task nobody checked to see whether or not it was performed correctly. Seafarers were unsure whether the HOD regarded complete autonomy as a pre-requisite for efficient ship operations.

The behaviour described in this section was what could be expected when a HOD displayed the 'Formalistic behaviour' described in Research Question 1. Research Question 1 also suggested that the accident rate increased when this type of behaviour was displayed. Thus when an environment like the one described above was experienced it is likely that the ship may experience an accident therefore working conditions in the Personal Growth dimension appeared to have an impact on the safety culture of a ship.

4.1.4.1.3 Analysis outcomes obtained for the 'Systems Maintenance and Change Dimension' Dimension

The `System Maintenance and Change' dimension had six clusters. Cluster 1 matched the description of '*Physical comfort'* (See Table 29) provided by Moos (1974). '*Physical comfort*' is the extent to which a ship's accommodation was conducive to efficient work practices and adequately met the needs of seafarers.

The responses indicated that seafarers were unsure as to whether the accommodation of a ship was suitable as a good workplace as their living spaces were not comfortable and the fittings in the accommodation did not facilitate efficient functioning.

Cluster 2 matched the description of '*Clarity*' provided by Moos (1974). '*Clarity*' is the extent to which rules and regulations were used to determine the work practices on a ship.

HODs frequently referred to the rules and regulations and used them as a means of supervision. Seafarers knew what tasks they were required to perform as their superiors had made these quite clear to them.

Table 29. Rotated component matrix (SM & CD dimension).

Items	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
	Physical Comfort	Clarity	Staff Supervision	Innovation	Work pressure	Reward System
PC 10	.597	.279	.029	.004	-.107	.195
PC32	.811	.028	.064	.047	-.014	-.073
PC43	.781	.119	-.016	.130	.051	-.094
C 7	-.037	.639	.094	-.115	.064	-.145
C 8	.227	.561	-.134	.129	.008	.126
C18	.181	.633	-.057	-.049	-.016	-.004
C40	.005	.477	.047	.178	.034	.023
C 41	.263	.447	-.114	.323	.016	.153
SS21	.057	-.195	.570	.190	-.014	.081
SS29	.005	.135	.633	-.027	.070	-.032
SS30	.209	.086	-.644	.170	-.201	-.051
SS31	-.141	.001	-.661	.220	.039	.101
I 9	.036	.072	-.197	.662	-.002	.013
I20	.009	-.137	.171	.729	-.027	-.104
I42	.120	.373	-.094	.562	-.042	.036
WP33	-.116	.069	.023	-.028	.795	-.124
WP44	.070	.013	.128	-.048	.803	.134
RS 11	-.168	.116	.253	-.030	.086	.685
RS22	-.162	.097	.324	-.006	.083	-.629
Item19	.265	.168	-.128	.319	-.093	.061
Rotation Method: Varimax with Kaiser Normalisation.						
Rotation converged in 7 iterations.						

Cluster 3 matched the description of '*Staff Supervision*' provided by Moos (1974). '*Staff Supervision*' is the extent to which the rules were applied to work practices aboard ship and how resistant to change these work practices were.

The responses indicated that rules and regulations covered all aspects of work that was performed aboard ship. The work routines however tended to be inflexible and followed what was accepted as 'the way that it has always been done'.

Cluster 4 matched the description of '*Innovation*' provided by Moos (1974). '*Innovation*' is the extent to which seafarers were permitted to be innovative when they performed tasks aboard ship.

The responses indicated that though HODs encouraged seafarers to be innovative and experiment with new routines they were not allowed this freedom for all tasks performed aboard ship.

Cluster 5 matched the description of '*Work pressure*' provided by Moos (1974). '*Work pressure* ' is the extent to which seafarers were expected to perform tasks efficiently regardless of the duration of the task and the time of day at which this task was performed.

The responses indicated that seafarers could be called back to work at any time regardless of how long they had worked prior to being called up. They were also expected to perform at peak efficiency regardless of the time of day.

Cluster 6 matched the description of '*Reward system*' provided by Moos (1974). '*Reward system*' is the consequences that were associated with poor performance and the extent to which this system influenced seafarer actions aboard ship.

The responses indicated that seafarers were always aware of the repercussions of poor performance. It was an issue, however, that they did not like to talk about.

In summary, seafarers found the ship's accommodation uncomfortable and not a good place in which to work. The data presented here accords well with the literature cited in Chapter Two, which referred to ergonomics as the most important causal factor related to accidents.

Seafarers regarded rules and regulations as pervasive as HODs often used them. The work routines aboard a ship were well known as there was very little variation from ship to ship. Seafarers were encouraged to be innovative in some tasks but were wary of the repercussions of poor performance in the work place. These data are in agreement with the literature reviewed as rules and regulations are a major moderating factor of seafarer behaviour as they are pervasive and govern all aspects of seafaring. It will be recalled that Roberts et al., (1994), the single relevant maritime study, suggested that seafarers engaged in avoidance behaviour and this study has identified fear of negative repercussions as being one the factors that encouraged this negative behaviour.

In the next chapter the study's data will be presented to address the Research Questions and to discuss it in the context of the extant literature.

Chapter. 5

Discussion and Conclusion

5.1 Introduction

The previous chapter presented the data from the analysis of the three instruments under each of the Research Questions. This chapter examines the relationships between these findings and that of extant literature and considers their impact on the safety culture of a ship. This is followed by a summary of the conclusions that emerged from these discussions and the chapter concludes by suggesting future directions for further research.

5.1.1 Research Question 1: How does a ship's crew perceive its organisational culture?

As outlined earlier, this Research Question had three sub-sections, namely:

- What observable behaviours do seafarers display when working aboard ship?
- What do seafarers value about their working environment?
- What assumptions guide the actions of seafarers?

The following sections discuss the data in relation to extant literature and the research questions.

5.1.1.1 'What observable behaviours do seafarers display when working aboard ship?'

As outlined in Chapter Two there is almost no directly relevant literature in the maritime field on the organisational culture of a ship. The literature that reviewed organisational culture came from cognate literature, while the literature associated with the maritime industry typically came from maritime accident investigation reports. These accident investigations were important to this study as they identified causal factors for maritime accidents, which had relevance to the safety culture and climate of a ship. The main focus of these accident investigations was however on the accidents themselves, while this study focussed on the organisational culture and climate of a ship. The accident investigation identified and listed the causal factors of an accident, while the current study evaluated the effect they had on the safety culture or climate of a ship. It was clear therefore, that the accident investigations and the current study had limited congruence. However, within this constraint the data are discussed.

Goss (1991) and Card (1995) described the impact of the economic environment faced by shipping companies and how this translated to pressures on seafarers and thus, essentially, on the safety culture of a ship. As a result of these pressures some companies may have become over-sensitive to these cost cutting pressures and focussed excessively on them. This focus in turn may have translated into pressure on seafarers in particular the HOD to contain costs, often at the expense of safety. These companies it may be said, had developed what may be termed as a 'pathological environment' towards safety (Reason, 1987).

In response to the high accident rates experienced by the industry, the International Maritime Regulatory Authorities developed several International Safety Conventions designed to improve a ship's safety culture (See 1.1.1.3). The rules prescribed by these International Safety Conventions were highly prescriptive with a strong focus on safe ship operations. The consequences of failure to comply with these conventions were that a ship was not allowed to ply. Any entity, including shipping companies, which operated in such conditions were therefore strongly inclined to comply with these regulations, often at the expense of other considerations such as efficient operations (MacGregor, 1960). Shipping companies transferred these compliance procedures and the resultant pressures on to the seafarers who worked on board ships. The data in cluster 2 and 3 in the `System Maintenance and Change' Dimension (see Chapter 4) supported the above contention as here seafarers stated that rules and regulations of the ship governed every aspect of a seafarers' working life aboard ship and the HODs often used them as supervisory tools (see section 4.1.4.1.3).

The demands made by the above two pressures on seafarers were often in conflict, especially within the operating environment of a ship for they placed a seafarer in the position of having to choose between the economic cost-cutting demands made by the shipping company and the regulatory demands made by International Maritime Regulatory Authorities. The data reported that seafarers believed safety regulations were good for the ship and seafarer safety (See section 4.1.1.1.2). The data also showed that the more strongly seafarers held this belief the accident rate on board a ship decreased (See section 4.1.1.1.2). Placing a seafarer in such a situation therefore did impact on the safety culture of a ship.

To compound these pressures many of the safety procedures devised by Regulatory Authorities took into account the concerns of shipowners and operators but not those of seafarers (see section 1.1.1.6), as they expected seafarers to comply with Safety procedures regardless of its impact on the operations of a ship. The data from this study did not directly address this issue, as they indicated that seafarers were expected to work longer hours than normal, if it were required, just to maintain the operational efficiency of the ship. They would however be negatively rewarded if they made mistakes or had an accident and therefore they would not report an accident if one did occur (see section 4.1.4.1.3). The above statements indicated that the normal workload of seafarers required them to work longer than normal hours on occasion. This could induce fatigue in them and make them more prone to have an accident, for which they would be negatively rewarded. The data may also indirectly support the literature which contended that the compliance procedures demanded by the Regulatory Authorities could increase a seafarer's workload.

In addition, the data from this study showed that seafarers had developed two behavioural patterns in response to the environment within which they worked. The first, known as the 'HOD Collegial behaviour' pattern (Table 15) appeared to encourage safe ship operations. When displaying this behaviour the HOD was very supportive toward subordinates, listened to them when they discussed work related issues and implemented many suggestions made by them. The HOD would also praise subordinates if they did a good job and demonstrated the correct way to accomplish a task if it was required. The described behaviour matched the 'satisfaction style' described by Roberts et al's., (1994) study. The data from this study suggested that when a HOD acted in this fashion the accident rate decreased (see section 4.1.1.1.1). The `HOD Collegial behaviour' pattern thus appeared to support a safer ship culture.

The second behaviour type known as the 'HOD Formalistic behaviour' pattern depicted an unapproachable and uncommunicative HOD, who displayed little interest in the operations of the ship. When displaying this behaviour pattern the HOD acted negatively toward subordinates by criticising them, not engaging them in work-related discussion or accepting any solutions proposed by them. The data from this study suggested that when a HOD acted in this manner the likelihood of an accident occurring on board ship increased (see section 4.1.1.1.1). The `HOD Formalistic behaviour' pattern therefore appeared to have a negative impact on the safety culture of the ship. These data are unique as there were no studies identified in the extant literature to provide the opportunity for comparisons and to allow detailed discussion. In that sense, the data need to be tested in subsequent studies.

5.1.1.2 What do seafarers value about their working environment?

Roberts et al's., (1994) study on the organisational culture of an aircraft carrier concluded that a shipboard culture was most likely to be a hybrid which combined elements of a Collegial and a Formal culture. A hybrid shipboard organisational culture at a superficial level appears to have all the structures and procedures of a formal organisation but, at a deeper and not so readily observable level, resembled a collegial organisation (see section 2.1.1.5 for a description of both types of organisations). The data from this study does not support the conclusions made by Roberts et al., (1994) (see Table 16 and Table 19) as the reported data showed that seafarers valued being members of a collegial organisation; in a clear preference for a `mono-culture' rather than an amalgam. It should be noted, however, that this relationship was established using an instrument that lacked sophistication and further studies are needed to establish that this is indeed the case.

In addition the data showed that when seafarers found themselves working in a non-collegial environment the accident rate increased (see section 4.1.1.1.1). The existence of a collegial culture on a ship therefore improved the safety culture of a ship. It is important to note there were no other relevant published studies on this matter cited in the literature except that by Roberts et al., (1994). The data in this study throw into relief the assertions by Roberts et al., (1994) and need further examination in subsequent empirical studies.

5.1.1.3 What assumptions guide the actions of people working aboard ship?

Some studies (e.g., Hare, 1962; Schein, 1985; Owens & Steinhoff, 1989) regard `assumptions' as the bedrock of culture. Assumptions are the 'filters' through which organisational members view their external environment and the yardstick that determined what was true and what was not (Owens & Steinhoff, 1989) and, more importantly, organisational members held them to be non-negotiable (Hare, 1962). It is these assumptions that shape the values and guide the observable behaviours of seafarers.

The data in this study suggest that seafarers perceived and acted as if they were members of a team when they worked aboard ship (see Table 39 and Appendix 6). In this 'Team' they saw an active sharing of ideas and actions to solve problems that arose. This assumption highlighted the value that seafarers placed on being members of a collegial culture and their desire to participate actively in the operations of a ship. These data are unique as no relevant studies were found in the intensive literature search utilising available electronic databases (see Table 4).

5.1.1.3.1 Summary of conclusions arrived at in Research Question 1

It will be recalled that to address the issue of organisational culture aboard ships two instruments were applied - The 'MCQ' (Maritime Culture Questionnaire) and the 'AtM' (Assumptions through Metaphor). This approach was necessary as the data gathering process for the `Observed Behaviour' and the `Values' was different to that required for the determination of `Assumptions'. The data from this study showed that the 'Observable Behaviour' that supported a safer culture on board a ship were the `HOD Collegial behaviour' pattern (see 4.1.1.1.1). The data also showed that the Collegial `Values' expressed by seafarers supported a safer culture on board a ship (see 4.1.1.1.2). In addition the data showed that seafarers preferred working as members of a team and when this environment existed on board a ship, the ship had a safer organisational culture than on a ship that did not (see 4.1.1.2). These data are unique as there were no studies identified in extant literature to provide the opportunity for comparisons and allow detailed discussion. In that sense the data need to be tested in subsequent studies.

5.1.2 Research Question 2: Does a common organisational culture exist on all ships?

Studies in cognate areas (e.g., Smircich, 1983; Davies & Weiner, 1985; Louis, 1985b) described factors and conditions that supported the formation of inter-organisational as well as intra-organisational cultures (see section 2.1.2.2). A critical synthesis of this information suggested that many conditions which encouraged the formation of inter-organisational as well as intra-organisational cultures could possibly exist on a ship.

Consequently, therefore, the question of whether or not a homogenous inter-organisational culture existed on board all ships needed to be addressed. The Research Question also aimed to examine whether or not there were any sub-cultures on board a ship. The specific issues addressed were:

- Is the organisational culture the same on all ships regardless of nationality?
- Does a seafarer's view of the organisational culture aboard ship depend on the department to which that seafarer belongs?

To assist the reader separate sections present and discuss the data from this study in relation to extant literature.

5.1.2.1 Is the organisational culture the same on all ships regardless of nationality?

Historically, maritime cultures arose in different countries and evolved alongside each other (see section 1.1.1.1). It was therefore likely that there were many parallel maritime cultures in existence. Louis (1985b) suggested that each ship that flew the flag of a different state would have a separate shipboard culture as the conditions that promoted a separate culture existed on board all ships.

The data in this study (see Table 12), however, showed that only one inter-organisational shipboard culture existed on board all ships, as the analysis could not differentiate between the replies of seafarers from different countries. These findings do not support Louis's (1985b) contention that the existence of conditions supporting the development of culture would necessarily result in the formation of a new one. The findings however do support the conclusions of other studies (Davies & Weiner, 1985; Schein, 1985), which contended that culture formation involved more complex processes than the mere presence or absence of favourable conditions.

There have been few empirical studies conducted in this area and in this case the conclusions drawn by Louis (1985), Schein (1985), and Davies & Weiner (1985) were a synthesis of the extant literature they examined. It was therefore not surprising that each arrived at different conclusions, as these may have been predicated on such factors as their personal experience and history. It was important however that this synthesis of the literature was conducted to gain a perspective on the issues being examined. What is important to note, however, is that even though the cited studies differed on some of the conclusions they were unanimous in agreement on the process of culture formation.

It should be noted that in this present study a correlational as well as regression analysis was used to determine whether the responses could be used to predict the 'nationality' or the 'department' of each respondent (see section 4.1.2.1). As such the relationships described above are linear relationships, it is possible that richer data may be gained on this issue by using a more in-depth and sophisticated statistical analysis.

5.1.2.2 Does a seafarer's view of the organisational culture aboard ship depend on the department to which that seafarer belongs?

Louis's (1985a) study identified and described many factors that encouraged the formation of intra-organisational sub-cultures. Many of these factors were present in the departments of each ship such as the Deck, Engineering, Ratings and Catering (see Appendix 1). It would thus be easy to presume that sub-cultures existed aboard ships.

The data from this study, however, was unable to determine the department of a seafarer from the responses that they had made (see Table 23 & Table 24), and this may lead to the conclusion that no sub-cultures existed on a ship. The findings from this study supported Davies & Weiner's (1985) conclusion that the formation of a sub-culture was more complex than mere presence of conditions within the organisation that promoted the formation of a sub-culture.

It should be noted that in this study the instrument and subsequent analysis were not designed to look for causes or factors involved in culture formation; rather, it sought to explore whether or not a relationship existed between the responses and culture.

5.1.3 Research Question 3: What is the relationship between human error and maritime accidents?

Many studies have examined investigations that were carried out after the occurrence of maritime accidents (Nitka, 1990; Goss, 1991; Select Committee, 1992; Shapovlov, 1992; Card, 1995; Cantwell, 1997; Cahill, 1997). One focus of this study was the underlying causes that promoted human involvement in these maritime accidents. With the extant literature in mind this Research Question investigated the following issues:

- Is there a statistically significant difference in the rate of occurrence of accidents between different sized ships?
- Is there a statistically significant difference in the rate of occurrence of accidents between ships of different flag-states?
- Is there a statistically significant difference in the rate of occurrence of accidents between different departments working aboard a ship?
- Is there a statistically significant difference in the rate of occurrence of accidents between ships having different crew sizes?
- Is there a statistically significant difference in the rate occurrence of accidents when correlated with the time-period a seafarer spends aboard ship?

The above items were placed as outcome variables in the MCQ. A correlational and regression analysis (Statview, 1995) was conducted to establish the relationship between each outcome variable and the frequency of accidents (see Table 25 and Table 26). The correlational analysis was used to establish whether or not a relationship existed between the variable and accidents. The regression analysis went further in that it was used to determine if the presence of the outcome variable could be used to predict whether an accident would or would not occur. These are addressed in turn below.

5.1.3.1 Is there a statistically significant difference in the rate of occurrence of accidents between different sizes of ship?

Goss (1991) contended that most accidents occurred on vessels of less than 500 tonnes. The accident figures provided by Lloyd's Register (see Appendix 2, Tables 30, 31 & 32) partially support this as the Tables showed that the most total ship losses occurred on ships of about 500 tonnes in the years 1997 and 1999 but it increased to 9000 tonnes in 1998. The results from this study suggested that more accidents occurred on vessels of 5000 tonnes (see Appendix 16, Table 112). It appears these findings do not support the conclusions drawn from the Lloyd's Register figures or those provided by Goss (1991). It should, however, be noted that the figures provided by Lloyd's Register are for the ships that were completely lost or destroyed as a result of an accident, whereas these data indicated only ships on which an accident had occurred, so it may be the case of not comparing like with like. The earlier studies need to be repeated to clarify this point. The relationship between tonnage and accidents was further subjected to a regression analysis, which indicated that ship size could not be used as a predictor of accidents (see Table 26). Thus while small ships may have more accidents the fact that a ship was small did not mean that it would have an accident. It is possible other factors were involved that mask this relationship and the instrument used to gather the data was not sophisticated enough to determine them. The extensive review of the literature was unable to find a similar published study that analysed the data in a similar fashion to provide comparisons and allow detailed discussion. The data from Lloyd's Register that was used for the comparisons only provided the tonnages of affected craft and made no attempt to analyse the material. As a consequence, while there is some agreement with the data provided by Goss (1991) and Lloyd's Register there was not enough to draw a solid conclusion. A more detailed study is required in this area to gain an insight into the other factors involved.

5.1.3.2 Is there a statistically significant difference in the rate of occurrence of accidents between ships of different flag-states?

Goss (1991) concluded that the training regimes in different countries and the attitudes of different cultures toward safety affected the safety record of ships. Besides the broad issue of culture, an employee's attitude toward safety also proved influential in determining the safety record of an organisation (Hunt & Habeck, 1993; Shannon & Walters, 1996).

The data from this study, to test this relationship, were inconclusive as it was found that although there was a relationship between accidents and the flags of different countries it was not possible to determine precisely the factors involved. This relationship was further tested using a regression analysis (see Table 25), which indicated that the 'Nationality' of a vessel was not an accurate predictor of the occurrence of an accident. The findings therefore only partially support the assertions of Goss (1991) as the available data suggested that though there were linkages between flag states and accidents it would require a more detailed study in this area to determine the precise factors linking accidents to 'Nationality'. It was possible that there were other factors that may be involved before such a direct linkage can be made. Not being able to identify these factors thus obscured the relationship between 'Nationality' and accidents and the data gathering instrument lacked the sophistication to determine them. The relationship therefore between 'Nationality' and accidents was not a simple linear one, but more complex.

The extensive review of the literature was unable to find, first, a study that analysed the data in a similar fashion, and second, any study to determine the inter-relationship between 'Nationality' and the occurrence of accidents. In this respect, therefore, the data from this study were unique. To ascertain their veracity further empirical studies are needed.

5.1.3.3 Is there a statistically significant difference in the rate of occurrence of accidents between different departments working aboard a ship?

The Deck department was reported to have a higher rate of accidents (e.g., Nielsen, 1998; Shapovlov, 1992) than others. On the other hand, Jaremin (1997) did not find any statistically significant difference between the departments. All three studies made conclusions based on the review of data provided by official ship casualty statistics from different flag states. The present study sought to determine a linkage between the responses provided by department members and maritime accidents through a correlation and regression analysis (see Table 26). The methodologies used by the other accident studies (e.g., Jaremin, 1997; Nielsen, 1998; Shapovlov, 1992) differed from each other as well as with the current study, therefore, a direct comparison cannot be made between this study and those cited.

The data from this study indicated that there was a weak relationship between the factor 'departments' and the rate of occurrence of accidents (see Table 25 & Table 26). The relationship was subjected to a further regression analysis, which indicated that the factor 'department' could not be used as a predictor of accidents. While the fact that a seafarer was working in a particular department may have been a factor in the occurrence of an accident it was a minor contributing one and not one of the main factors, as evidenced by the correlation. Here too the relationship appeared to be clouded by other factors that this study was unable to identify. It did however clarify that the relationship between 'department' and the occurrence of accidents was more complex than had hitherto been thought.

Again the extensive review of the literature was unable to find a similar published study to provide comparisons and to allow detailed discussion. In this respect therefore, the data from this study were unique and need to verified in subsequent studies.

5.1.3.4 Is there a statistically significant difference in the rate of occurrence of accidents between ships having different crew sizes?

Cahill (1997) has argued that the continued reduction of crew numbers on board ship was not good for ship operations as it increased the crew's workload and therefore increased the likelihood of an accident occurring on board. The extensive review of the literature was unable to find a study that analysed the data in a similar fashion to that adopted here or any study that determined the inter-relationship between 'Crew-size' and the occurrence of accidents.

The data from this study did not support Cahill's (1997) central assertion, as it was unable to find a correlation between the number of persons working aboard ships and the rate of occurrence of accidents. This relationship was further subjected to a regression analysis which indicated that the number of persons working aboard a ship could not be used as a predictor for the occurrence of an accident aboard a ship (see Table 26). These data are unique as there were no relevant studies identified in the literature to provide a comparative analysis. It is important to note that Cahill's (1997) assertions were the result of a synthesis of extant literature and did not have a direct empirical basis.

5.1.3.5 Is there a statistically significant difference in the rate of occurrence of accidents when correlated with the time-period seafarers stay aboard ship?

Some studies (e.g., Nitka, 1990; Wagenaar, 1990) indicated that when seafarers spent prolonged periods away from supportive social structures it affected their mental health, which in turn impacted on the frequency of occurrence of accidents.

This study found no correlation between the time seafarers spent aboard ship and the occurrence of accidents. The relationship was further subjected to a regression analysis which indicated that the length of stay on board a ship could not be used as a predictor for an accident (see Table

26). The data from this study was therefore unable to support the conclusions of the cited studies. Nitka's (1990) conclusions were based on a synthesis of extant literature and as such was not empirically based. It is, therefore, perhaps not surprising that his conclusions, differed from that of the current study. Wagenaar's (1990) conclusions however, were based on a study of 100 maritime accidents. Wagennar studied each accident and listed all the causes that he discerned were associated with each accident. These causes he grouped into three categories and then the frequency of occurrence was calculated for each category (see Appendix 3, Table 36). The conclusions he made were not statistically analysed other than obtaining the frequency distribution described above. The most readily apparent comment concerning Wagenaar's (1990) study was the absence of statistical procedures on the data. As the methodology used by the current study differed from that conducted by Wagenaar (1990) a direct comparison between the findings of each study cannot be made. Apart from the two studies identified above there were no directly relevant studies cited in extant literature. In this respect, therefore, the data from this study were unique and need to verified in subsequent studies.

5.1.4 Research Question 4: How does a ship's crew perceive its organisational climate?

The are a few directly relevant studies cited in the literature and the studies by Moos (1974) and Fisher, Docker and Fraser (1986) were perhaps the most useful as they provide comparative studies (see Appendix 9, Table 55). This study therefore had to use cognate literature from areas, such as education and business (e.g., Bennis & Nanus, 1985; Moos, 1986; Sergiovanni, 1987) to develop a model that would enable a study of the organisational climate of a ship to be conducted. The instrument selected was the Maritime Climate Questionnaire (MClQ) (See section 3.1.1.2.11), which was developed by Moos (1974). The responses were categorised into three dimensions, 'Relationship', 'Personal Growth' and 'System Maintenance and Change'.

Much of the literature that related to the maritime industry in this broad area were medical studies conducted on the physical (Brandt et al., 1994; Cahill, 1997; Finland, 1997; Goss, 1991; Helmkamp & Bone, 1986; Monk & Folkard, 1985; Olkinoura, 1984; Shapovlov, 1992) and mental health of seafarers (Barnes, 1984; Barss, 1990; Filikowski et al., 1992; Levy, 1972; Nitka, 1990; Wagenaar, 1989).

The following sections describe how seafarers react to the current climate within the industry.

5.1.4.1 Relationship Dimension

Moos (1985) described 'Involvement', 'Peer Cohesion', 'Expressiveness' and 'Supervisor Support' as contributing components to this dimension (see Table 8).

The data relating to 'Involvement' describe seafarers in two important ways. First they report high levels of pride in performing their tasks to best practice standards. Second, seafarers expressed a common wish for meaningful lives that had purpose. In these respects the data reflected some of the findings reported by Sergiovanni (1987); in essence, the data here and Sergiovanni's study show different workplaces with similar needs and aspirations, namely, the need for professional and personal achievement. It also highlights the absence of attention paid to this aspect by shipowners and Regulatory bodies.

The 'Peer Cohesion' component was perceived by seafarers as one where the HOD was able to work with the other group members, to facilitate strong norms and expectations regarding behaviour. The dimensions of this component are in many ways similar to those that this study labelled 'Collegial behaviour' and ascribed to HODs. The study by Roberts et al., (1994) (described in section 2.1.1.5) also shared some of the aspects of groupness, i.e., norms, behavioural expectations and possible sanctions if behaviours were deemed inappropriate, in the category she termed 'Satisfaction style'.

The data reported in Chapter 4 relating to the 'Expressiveness' component again describe seafarers in two important ways. First, seafarers indicated they were unafraid to express opinions freely when they worked aboard ship. Second, they expressed a desire to have a reasonable influence over events and circumstances governing their lives. In these respects the data reflected some of the conclusions drawn by Sergiovanni (1987) where seafarers expressed similar aspirations as workers from other workplaces in wanting to exert a certain amount of control over their working lives.

In the `Staff Support' component seafarers focussed on its negative side, by stating their reasons for not reporting undetected accidents. They justified these actions by saying that it occurred as a result of their fear of the negative repercussions that ensued following an accident. This reflected one of the consequences of a negative reward system. The data showed that seafarers made a distinction between freely exchanging work related information and the reporting of accidents. The stated reason for this distinction was their fear of the consequences that such an act might entail, which included dismissal from the ship. The data from another instrument (MCQ) used in this study provided further support to the above by showing that this behaviour generally manifested itself when the HOD displayed the 'Formalistic' behaviour pattern (see section 4.1.1.1.1). The earlier cited study by Roberts et al., (1994) (see section 2.1.1.5), also shared some of the aspects of this study as that study reported similar avoidance behaviour loading on all aspects of seafarer activity.

5.1.4.2 The Personal Development Dimension

Moos (1985) described the contributing components to this dimension (see Table 8) as being 'Autonomy' and 'Task Orientation'.

In the 'Autonomy' component seafarers reported that they had the autonomy to perform tasks but were not sure whether this promoted efficiency.

In the 'Task Orientation' component seafarers reported that no standard method existed aboard to perform a task and nobody checked whether it was accomplished properly or not.

When both components were considered together it appeared that seafarers regarded both components in a negative light in that they felt that there was a lack of standardisation and a monitoring mechanism to detect faulty work. Thus the data suggested that having the autonomy to determine a procedure to perform a task without a monitoring mechanism would only add to the diversity of procedures. In turn this would lead to inefficiency as many tasks may have had to be redone if the outcome was unsatisfactory.

Seafarers were expected to perform efficiently regardless of the time of day. The data suggested that seafarers could also be recalled to perform other tasks, should a situation demand, regardless of how long they had worked in the preceding period.

There were few directly relevant studies cited in extant literature and the studies on fatigue (see Table 6) were the most useful. Fatigue had been cited as a causal factor in many maritime accidents and the data from this study has refined this finding by identifying two causal factors. The first was the repetition of improperly completed tasks and the second was long working hours. As there were no comparable studies these findings need to be tested in subsequent research.

5.1.4.3 System Maintenance and Change Dimension

The components that made up this dimension are displayed in Table 29 and the major ones are `Physical Environment', `Clarity', `Staff Supervision', `Innovation', `Work Pressure' and `Reward System'.

In this dimension seafarers reported that they found the accommodation space not suitable as a working area and it was uncomfortable as a place to live. The reader will recall that there were very few directly relevant studies in this area and the only broad connection that the study was able to make between the reported data and maritime casualty studies was that 'ergonomic issues' were the largest causal factor in the occurrence of maritime accidents (Table 5). The vast majority of control stations and workspaces on board a ship are situated within the accommodation. It is possible that some aspects of the accommodation, which had caused discomfort to seafarers, also were contributory factors to the occurrence of accidents.

In the 'Clarity' component seafarers reported the reliance of the HOD on rules and regulations as a means of supervision and for the imposition of sanctions. When this occurred seafarers would display avoidance behaviour. The study by Roberts et al., (1994) (described in section 2.1.1.5) identified this avoidance behaviour amongst seafarers and the data from this study provides insights as to when this avoidance behaviour can be expected. In this regard the present study has refined an important earlier study.

5.1.5 Contribution of the Study

This study presented the following data that were unique:

- described the 'Collegial' behaviour pattern of HODs
- described the 'Formalistic' behaviour pattern of HODs
- linked the display of 'Collegial' behaviour of HODs with a safer ship organisational culture
- linked the 'Formalistic' behaviour pattern of HODs with a less safe ship organisational culture
- linked seafarer 'Values' as a factor that supported a 'Collegial' culture
- linked the existence of a 'Collegial' culture on board a ship as a factor that promoted a ship's safety culture
- linked that the display by the HOD of `Formalistic' behaviour encouraged avoidance behaviour amongst seafarers

- identified that when seafarers worked aboard ship they assumed that they were members of a team
- deduced that a common shipboard organisational culture existed on all ships
- deduced that ships may not have sub-cultures
- deduced that the fact a ship is small does not predispose it toward having an accident
- deduced that the fact a ship is from a particular flag state does not predispose it toward having an accident
- deduced that the fact that a seafarer is from a particular department does not predispose that person toward having an accident
- deduced that the longer a seafarer stays aboard a ship does not predispose that person toward having an accident
- identified that the lack of standardisation of work procedures was a factor that did not support a safer ship climate
- identified that seafarers had to work long hours, on occasion, just to maintain the operational efficiency of a ship
- identified that the repetition of improperly performed tasks and long working hours were factors that seafarers cited were causing fatigue
- identified that seafarers found the ship's accommodation an uncomfortable place in which to work
- indicated that compliance with regulatory procedures of the industry may increase the workload of a seafarer
- identified that the lack of attention by shipowners and Regulatory Authorities of the needs and aspirations of seafarers could impact on the safety culture of a ship
- identified the negative reward system of the maritime industry as a factor that did not support a safer culture on the ship

This study presented data that refined existing studies in the following areas:

- identified some instances where seafarers would display avoidance behaviour
- identified the seafarer's preference toward working in a 'Collegial' culture
- concluded that most maritime accidents that involved human factors occurred as a result of skill based errors
- concluded that knowledge based errors formed the second largest group of causal factors for maritime accidents
- suggested there were some other and perhaps larger factors which when linked with ship size would predispose a ship toward an accident
- suggested there were some other and perhaps larger factors which when linked with the flag state of a ship would predispose a ship toward an accident
- suggested there were some other and perhaps larger factors which when linked with the department in which a seafarer works predisposed that seafarer toward an accident

The other contributions of this thesis were that it:

- provided a unique description of the three stages of Organisational Culture of a ship and linked it to extant literature
- provided a descriptive analysis of some possible linkages between the Organisational Culture of a ship and maritime accidents
- analysed possible components of the Organisational Climate of a ship as it related to the safety culture of a ship
- provided a possible descriptive linkage between the Organisational Climate of a ship and accidents

With the above in mind, a number of suggestions for future research emerged and these will be discussed in the next section.

5.1.6 Suggestions for future research.

There are a number of areas where future research may be conducted as a result of this study and these include methodological, theoretical and practical areas.

In this study a more quantitative approach was chosen and three instruments were the vehicles used to achieve its stated aims. Analysis of the data gathered by the instruments enabled a description of Organisational Culture and Climate of a ship to emerge. While analysis of the data revealed much new information there were some instances during analysis where it was recognised that the instruments or the methodology used lacked the sophistication to gain deeper insights into identified areas.

One area that highlighted this was the lack of a common understanding of the metaphors used by this study. A study that focussed on metaphors that had common understandings across many cultures would provide very useful data for the industry.

The one published study that this study was able to relate directly to was conducted by Roberts et al., (1994), highlighting the paucity of extant literature. As a result the present study was unable to focus on and examine in depth, issues from which richer discussion may have eventuated. A useful way forward, therefore would be to conduct a number of smaller studies, such as action research projects (Burns, 2000), in a small number of specific institutions, ships or companies. The studies would then provide a database from which to develop more generalisable and, perhaps, testable findings.

One cognate area where there is much literature but none in the maritime field was the cognitive mechanisms involved in error creation amongst seafarers that lead to maritime accidents. An important related study may be taken up in the domain of psychology for the cognitive mechanisms involved in maritime accidents, e.g., meta-cognition, could be a focus. A similar related study that may be taken up could be to examine the biases or deep-rooted tendencies (Senders & Moray, 1991) held by seafarers, which generated errors culminating in an accident.

In the area of the Organisational Climate of a ship the issue of 'ergonomic factors' had been highlighted as being the major cause of maritime accidents (see 2.1.4.2). This study has dealt with the issue only in general terms, as it was not the primary focus of this thesis. A more focussed and in-depth study on person/machine interface issues and how they may be mitigated would generate much rich and useful data for the industry.

Also in the area of the Organisational Climate of a ship the issue of fatigue had been highlighted as being another major cause of accidents (see 2.1.4.2). This study has dealt with the issue only in general terms, as it was not the primary focus of this thesis. A more focussed and in-depth study on seafarer fatigue and how they may be mitigated would generate much rich and useful data for the industry.

The negative reward system used by the industry and the avoidance behaviour displayed by seafarers have been highlighted by this study. The data from this study showed that when faced with the prospect of facing the consequences of the reward system and when the HOD displayed 'Formalistic' behaviour, seafarers would display avoidance behaviour. This display of avoidance behaviour by seafarers, however, has not been dealt with in a manner such an important issue deserved. A study that examined these two aspects would provide important information that would be of great benefit to understanding and promoting the safety culture of a ship.

Other issues that this study did not deal with at all but were important to the industry were, what are the mechanisms that facilitate the transfer of cultural attributes such as 'values' and 'assumptions' from one seafarer to another? And, how does the social interaction amongst seafarers on board ship affect their working relationships and environment?

Instrument design also limited the scope for analysis of the data. One of the areas affected was the issue of sub-cultures. The instrument design only allowed a correlational analysis to determine whether a relationship existed or not. The analysis, however, would not be able to provide the reasons for the existence or non-existence of the relationship. A more sophisticated study that examined the issues involved in culture formation and the impact they had on the formation of sub-cultures on board a ship would provide useful information on the processes involved in cultural development on board a ship.

Other relationships that perhaps were affected by the limitations of instrument design were the correlations between 'nationality', 'ship size', 'department' and maritime accidents. The reasons as to why the relationship did or did not exist were not examined as a result. Studies that examined each aspect individually and the issues associated with them would be useful in revealing the other factors that were concealed to this study and so provide a better understanding on the association between some of these factors and accidents.

The present study used a method aimed at theory building to better understand the impact that Organisational Culture and Climate on board ship had on accidents. There is a need to test the findings and the conclusions drawn by this study. The necessary tests were whether the conclusions made using the data were generalisable to other workplace environments and to the maritime industry as a whole. Although this study had used mainly a quantitative methodology, the research studies described above could use a range of differing techniques. For instance, to examine the cognitive aspects of error generation within the industry, a qualitative approach (Burns, 2000) using a maritime accident investigator's viewpoint may provide very useful information to accident investigators investigating accidents within the industry.

The data presented above may also have implications on the normal practices of seafarers. It would be useful therefore to explore further some work practices that relate to safety, communications and intra-group relations. One useful way to do this might be to ascertain if the findings from here were salient in other work places. Issues that might be examined were, 'do other workplaces have similar elements of structure and culture?' 'What influence do the culture and climate have on individuals working in those environments? Does the effects of culture and climate have a similar effect on the safety environment of other workplaces?'

More research is needed in the areas of Shipboard Organisational Culture and Climate, as it is likely that this study has not identified and described all the issues that were likely to impact on the safety culture of a ship.

Finally, while the issue of sub-cultures was investigated by this study it is likely that a deeper and more focussed study would generate richer data. A suggested way forward would be to develop an instrument specifically to determine whether sub-cultures exist within the Organisational Culture of a ship, based on the principles espoused by Louis (1985).

5.1.6.1 Conclusions

This study has demonstrated that seafarers displayed two behavioural patterns - one of which appeared to increase the likelihood of an accident occurring. The study also showed that seafarers preferred working in a collegial environment and that making them work in another type of environment appeared to have an adverse effect on the rate of occurrence of accidents. The study also highlighted the effects of the two dominating influences the economic and the regulatory climate on the maritime industry.

The issues raised by this study are very broad and affect the whole industry and a single or simplistic solution to address them would not be effective. There are a multiplicity of ways in which they may be addressed; this section lists the conclusions under three different groups, policy makers, shipowners and Heads of Departments.

5.1.6.1.1 Policy makers

This section is directed toward those persons who work in the Regulatory sector of the Maritime Industry such as The International Maritime Organisation, National Safety Organisations, Classification Societies and Marine Insurance companies. The data in this study suggest:

- The regulatory sector needs to assist seafarers to maintain a safe operating environment by being less prescriptive and introducing regulations that have received more input from seafarers and,
- The current compliance procedures demanded by the Regulatory sector do not take into account its impact on seafarer workloads and also when compliance with these procedures must be carried out. For instance, most ship surveys occur when a ship is loading or discharging, which is a very busy period in the working cycle of a ship.

5.1.6.1.2 Shipowners

This section is directed toward shipowners and ship managers who manage seafarers and the ships that ply on the international trading routes of the world. The data in this study suggest:

- Shipowners need to create a safety culture on board each of their ships that will not be over ridden by cost reducing regimes,
- Shipowners need to foster a collegial culture on board their ships as it has been identified as an important environmental determinant that promotes safety and,
- Shipowners needed to pay closer attention to the aspirational needs of seafarers as lack of attention in this area could affect the safety climate of the ship

- Shipowners need to establish a reward system that is positive as the current reward system is perceived as negative and harmful to the safety culture of a ship

5.1.6.1.3 Heads of Departments

This section is directed toward the Heads of Departments of the various departments of a ship, namely the Deck and Engineering departments. The data in this study suggest:

- HODs and seafarers should be educated on the impact their behaviours have on the safety environment of the ship, and be encouraged to display the positive behaviour patterns that were shown to reduce the occurrence of accidents.
- The HOD should foster a collegial atmosphere on board as this atmosphere promotes the ship's safety culture.
- HODs should not allow cost considerations to override safety issues and,
- HODs should allow subordinates to have an input in the running of the departments as this improves the safety climate of the ship.

This study has examined only a narrow band of issues that govern the lives of seafarers. It has gained some important insights into the Organisational Culture and Climate of ships and their safety environment and has suggested some 'remedial' measures that should be implemented. There are however a myriad of other issues that require research, many of which will be of great significance to the industry. The author looks forward to studying some of these areas in the future and collaborating with others to further the goal of creating a safer marine environment.

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Appendix 1

A functional description of the Departments aboard a ship

A functional description of the Departments aboard a ship

The person in charge or command of a ship is the Master. Traditionally this person is drawn from the Navigation or Deck department. The two names Navigation and Deck are used interchangeably for this particular department. The reason for this is that the department performs three functions namely `Navigation', `Cargo Operations' and `routine maintenance' of the ship. The Navigational department is therefore concerned with the navigation of the vessel. The Deck department is however concerned with cargo operations and the routine maintenance.

The Navigation/Deck department consists of a Chief Mate or Officer, the names 'Mate' and 'Officer' also are used interchangeably. The Chief Mate is considered the Head of the Deck department while the Master is considered the Head of the Navigation Department. A possible reason for this segregation of function is when the ship is in port the Master is required to attend to the logistical and other requirements of the ship. There would therefore be little time for this person to devote attention toward cargo related operations. This function therefore typically devolves to the Chief Mate who has the further task of maintaining the ship's structure.

The other members of this department are the Second Mate and perhaps a Third or Fourth Mate. The presence of the latter two aboard depends on the policy that a shipping company has with respect to the crewing of their ships. As an example, some companies require a Master to keep a navigation watch. At a minimum a ship generally requires three watch-keepers to maintain an efficient navigational watch whilst the ship is at sea. Having the Master keep a navigation watch would enable a ship to sail without a Third Officer. This is the reason why a ship may not have a third or fourth Navigating Officer. A similar reason can be applied for the disappearance of the 3rd/4th and the 4th/5th Engineers.

One of the primary tasks of the Deck or Navigation department of a cargo ship is the navigation of the ship. This involves sailing a ship safely from one port to another. Its other primary task is cargo operations, which involves the planning, and stowage of the cargo and supervising cargo operations. The department also is responsible for making a ship seaworthy, a process called 'battening down', prior to sailing out to sea. There are a number of other miscellaneous functions that the department performs. The first is the maintenance of all cargo-related gear not categorised as machinery. For instance if a ship has cargo or ship-stores cranes, the Engineering Department would maintain the hoisting machinery, while the Deck Department would maintain the wire ropes and sheaves on those cranes. The department's maintenance functions also extend to the ship's Life-saving and Fire-fighting equipment, non-machinery related structure of the ship and the medical supplies of the vessel. Medicines are dispensed, if required, by one of the Officers of the department. The department must also maintain inventories of all relevant stores and equipment.

The above two functions have created two routines aboard ship. The first is a 'port routine' where the time scheduling of a watch-keeper's working hours is designed for the maintenance of an efficient cargo watch. The cargo watch is usually shared between the Second and the Third Mate. The Chief Mate generally plans the operation and supervises its execution. These hours are quite varied, for instance in a twenty-four hour period, each Mate will keep watch for six hours and have twelve hours off watch, while the other Mate keeps watch in the reverse order. If there is a second twenty-four hour period these timings are reversed between the two watch-keepers.

When a ship is in port the Engineers keep a 'day work' routine. During this period they overhaul machinery, which can only be done in port; as well as keep the necessary utility services, required for the vessels port stay, functioning efficiently.

The second routine is when a ship is at sea, i.e., the sea routine; here the routine is designed so that all watch-keepers maintain an efficient navigation watch. Three mates who could be the Chief, Second and Third Mates, or the Master, Chief and Second Mate keep these watches. This routine generally has a watch-keeper doing a four-hour period on navigation watch and then an eight-hour off period. In the off period the watch-keepers are expected to rest, have meals, as well as perform tasks that cannot be performed when they are on the bridge. For example, the maintenance of Life saving and Fire fighting equipment is carried out during these hours.

When the vessel is at sea the Engineers keep similar watchkeeping hours as the Navigators. During this time they maintain the functional efficiency of the vessel's propulsion equipment; as well as attend to the vessel's planned maintenance schedule.

The Head of the Engineering Department is the Chief Engineer, followed by a Second and Third Engineer. There may in addition be a Fourth as well as some Fifth Engineers; their presence depends on the crewing policy of the shipping company.

Though the Engine Department was initially created to maintain and keep the ship's engine running. It eventually evolved to encompass the maintenance and running of all the mechanical, electrical and refrigeration equipment as they were introduced aboard ship. In addition the department is required to maintain inventories of the stores and spare parts required to accomplish the above tasks.

As mentioned each department has two skill categories. The first category is the Officers and Engineers, both of whom possess relevant Certificates of Competency. A Flag State's Safety Authority issues these Certificates of Competency. They certify that a person is competent to carry out duties aboard ship at the appropriate level for which a certificate is issued. The Deck department has three levels of certification; the lowest is for a Second Mate, the next higher for a Chief Mate and the highest for a Master Class 1. The Engineers also have three levels of certification; the lowest for a Watch-keeper, next a Second Engineer and then for a Chief Engineer. For the Engineering Department, certificates are issued separately for diesel as well as steamships. To have a joint Steam cum Diesel certificate a person has to complete the necessary subjects and sea service for each section.

Ratings, the other category, are however awarded Certificates of Proficiency for Integrated Ratings and certificates of Rating for a Deck Rating, Engine Rating and for an Able Seaman. Certificates of Proficiency are awarded to signify that a person is proficient in performing tasks required for the successful outcome of a particular operation. The relevant safety authority specifies the areas and subjects in which they are to be trained. Ratings assist watch-keeping officers, also known as watch-keepers, in the routine maintenance of the ship.

An Integrated Rating is a person who is trained to work both on deck as well as the engine room. The tendency today is to train ratings in skills that permit them to work both on deck, as well as the engine room. This allows them to be deployed in both areas reducing the number of ratings deployed per ship. A pump person is a specialised position held by a rating, and is a person who operates the cargo pumps on petroleum tankers.

The third functionally distinct category is the Catering Department, whose personnel attend to the catering and housekeeping requirements of the personnel living on board ship. The composition of the catering crew aboard cargo ships and passenger ships are very different. On Cargo ships they are very small, as they have only to cater for the Officers and Ratings. On Passenger ships however this is easily the largest department, as it has to cater to the needs of all passengers as well as the seafarers who crew it.

The Catering Department on board a Cargo ship generally consists of one or more cooks, a steward or stewards and perhaps a Chief Steward. The presence of the Chief Steward and the others mentioned above would depend on the trade and crewing policies of the shipping company. Many functions such as the laundering of the bed and bath linen for seafarers are done ashore when the ship is in port. A Passenger or Cruise liner would have not only a Chief Steward but in some cases many assistants as well. It would also consist of a Purser who may have Assistant Pursers. The department would have many cooks as well as stewards, laundry persons, bar attendants, miscellaneous catering staff and other cabin staff to attend to the needs of passengers.

All the departments are highly autonomous and function independently, with a limited interaction between the members of each department. In addition the Mates and the Engineers have their own highly developed jargon that is unique to the department. The Mates and the Engineers also have their own Professional organisations to which they can become members, for the mates it is the `Nautical Institute' and `The Company of Master Mariners' and for the Engineers it is `The Institute of Marine Engineers'.

Appendix 2

Summary of Lloyds' Register of Shipping accident statistics for the years 1997, 1998, 1999.

Table 30. Summary of Lloyd's Register of Shipping accident statistics for 1997.

Summary of Statistics	for 1997		
Flag of Registration	No of ships	Gross tonnage of ships	Age of ship (years)
Turkey	7	117660	33
Cyprus	6	105567	20
Panama	8	102166	23
Hong Kong (China)	1	79822	8
United States of America	11	76246	23
Saint Vincent	7	72873	28
India	3	52442	20
Malta	2	32616	23
Thailand	5	22813	25
Greece	2	16976	22
Russia	1	13157	27
Bahamas	3	11255	18
Antigua & Barbuda	4	11011	24
Cambodia	1	9387	27
Germany	1	8633	1
Japan	13	7488	13
Belize	5	6777	24
Ukraine	2	6629	31
China	4	6619	14
Indonesia	3	5196	23
Philippines	1	4996	17
Honduras	6	4049	31
Korea (South)	3	3705	21
Romania	1	3493	23
Mauritius	1	2966	19
Mozambique	3	2431	33
Singapore	1	2225	25
Egypt	1	2116	26
Malaysia	2	1540	36
Unknown	1	1415	18
France	2	1190	21
Syria	1	1186	38
Korea (North)	1	821	31
Argentina	2	799	29
South Africa	1	726	25
China (Taiwan)	1	719	7
Spain	2	588	29
Italy	1	535	21
Colombia	1	447	31
Qatar	1	391	28
Sri Lanka	1	316	21
Papua New Guinea	1	310	28
Maldive Islands	1	298	30
Norway	1	271	22
Iceland	1	266	34
Sierra Leone	1	260	31

Flag of Registration	No of ships	Gross tonnage of ships	Age of ship (years)
Cook Islands	*1*	*208*	*29*
Peru	*1*	*176*	*29*
Finland	*1*	*174*	*34*
Venezuela	*1*	*135*	*24*
Total	**132**	**804085**	**1218**

Table 31. Summary of Lloyd's Register of Shipping accident statistics for 1998.

Summary of statistics	for 1998		
Flag of Registration	**No of ships**	**Gross tonnage of ships**	**Age of ship (years)**
Saint Vincent	*11*	*105421*	*25*
Panama	*15*	*102910*	*25*
Liberia	*5*	*59641*	*25*
Cyprus	*5*	*56732*	*22*
Philippines	*2*	*52967*	*19*
Belize	*17*	*38086*	*27*
Malta	*4*	*33382*	*20*
United Kingdom	*8*	*26010*	*22*
China	*2*	*22959*	*13*
Greece	*2*	*22364*	*26*
Turkey	*6*	*14243*	*47*
Singapore	*4*	*12185*	*18*
Indonesia	*5*	*10061*	*20*
Korea (North)	*1*	*9451*	*29*
Honduras	*6*	*8951*	*31*
Russia	*9*	*7889*	*23*
Korea (South)	*4*	*7538*	*14*
India	*3*	*6901*	*23*
Spain	*7*	*6480*	*25*
Ukraine	*3*	*5801*	*25*
Cambodia	*2*	*4574*	*30*
Argentina	*2*	*4105*	*29*
United States of America	*8*	*3989*	*16*
Norway (NIS)	*1*	*3559*	*26*
Malaysia	*1*	*3007*	*16*
Congo	*1*	*2875*	*28*
Antigua & Barbuda	*1*	*2863*	*27*
Syria	*1*	*2706*	*35*
Venezuela	*1*	*2655*	*28*
Norway	*3*	*2584*	*29*
Bahamas	*1*	*2326*	*26*
Denmark (DIS)	*2*	*2125*	*18*
Romania	*1*	*2075*	*20*
France	*3*	*2065*	*21*
Austria	*1*	*1935*	*22*
Japan	*8*	*1784*	*13*
Vietnam	*1*	*1442*	*18*
Equatorial Guinea	*2*	*1050*	*48*
Unknown	*1*	*881*	*23*
South Africa	*1*	*752*	*13*
Ethiopia	*1*	*579*	*56*
Namibia	*2*	*481*	*32*

Flag of Registration	No of ships	Gross tonnage of ships	Age of ship (years)
Ghana	*2*	*439*	*29*
Denmark	*2*	*385*	*48*
Sierra Leone	*1*	*300*	*34*
Irish Republic	*2*	*259*	*32*
Canada	*2*	*205*	*11*
Estonia	*1*	*181*	*37*
Poland	*1*	*107*	*20*
Total	**175**	**662260**	**1264**

Table 32. Summary of Lloyd's Register of Shipping accident statistics for 1999.

Summary of Statistics	for 1999		
Flag of Registration	**No of ships**	**Gross tonnage of ships**	**Age of ship (years)**
Panama	*16*	*208645*	*19*
Cyprus	*9*	*148305*	*23*
Belize	*8*	*71915*	*27*
Saint Vincent	*9*	*49710*	*26*
Philippines	*4*	*39815*	*19*
Malta	*4*	*30876*	*21*
Turkey	*6*	*25399*	*36*
China	*2*	*23160*	*24*
Netherland Antilles	*1*	*21162*	*16*
Korea (North)	*1*	*10379*	*22*
Syria	*2*	*6829*	*29*
Greece	*3*	*6537*	*31*
Korea (South)	*3*	*6509*	*14*
Norway (NIS)	*2*	*6114*	*24*
Marshall Islands	*1*	*5938*	*17*
Bulgaria	*1*	*5926*	*23*
Antigua & Barbuda	*1*	*5753*	*9*
Indonesia	*3*	*4430*	*20*
India	*1*	*4356*	*22*
China (Taiwan)	*1*	*3972*	*20*
Nigeria	*2*	*3008*	*30*
Sâo Tome & Principè	*1*	*2796*	*37*
Denmark (DIS)	*2*	*2244*	*27*
Japan	*4*	*2068*	*16*
Norway	*3*	*1924*	*27*
Spain	*6*	*1790*	*26*
United States of America	*10*	*1519*	*24*
Spain (CSR)	*1*	*1465*	*19*
United Kingdom	*7*	*1117*	*24*
South Africa	*1*	*1024*	*30*
Croatia	*2*	*624*	*48*
Mauritania	*1*	*618*	*29*
Russia	*3*	*524*	*26*
Uruguay	*2*	*463*	*21*
Paraguay	*1*	*459*	*40*
Honduras	*1*	*398*	*32*
Mozambique	*1*	*353*	*22*
Dominica	*1*	*289*	*48*
Singapore	*1*	*247*	*9*
Brazil	*1*	*232*	*12*
Total	**129**	**708892**	

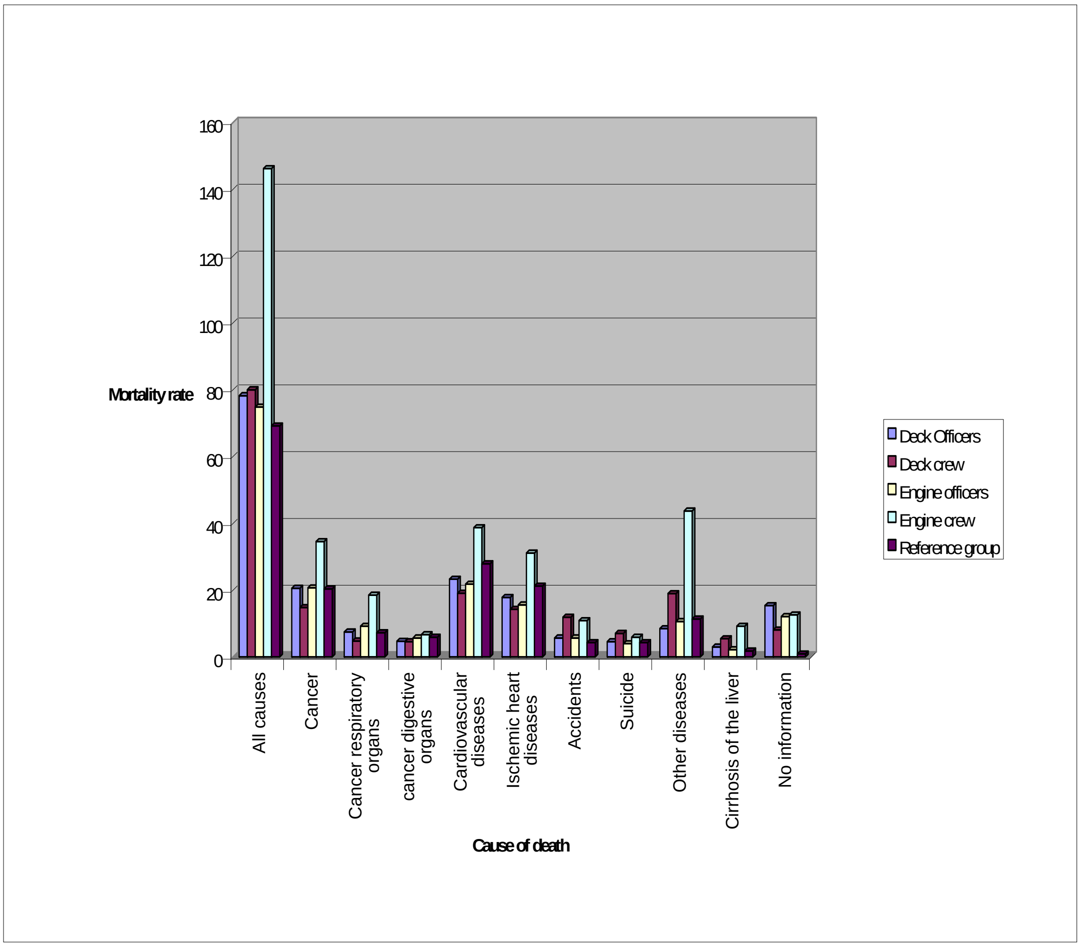
Table 33. Table summarising the total ship losses suffered by the Maritime Industry in the years 1997, 1998,1999.

Descriptive	**1997**	**1998**	**1999**
Mode	*499*	*9339*	*497*
Median	*2195*	*2718.5*	*3905*
Mean	*7580.287*	*5209.786*	*7249.929*

Appendix 3

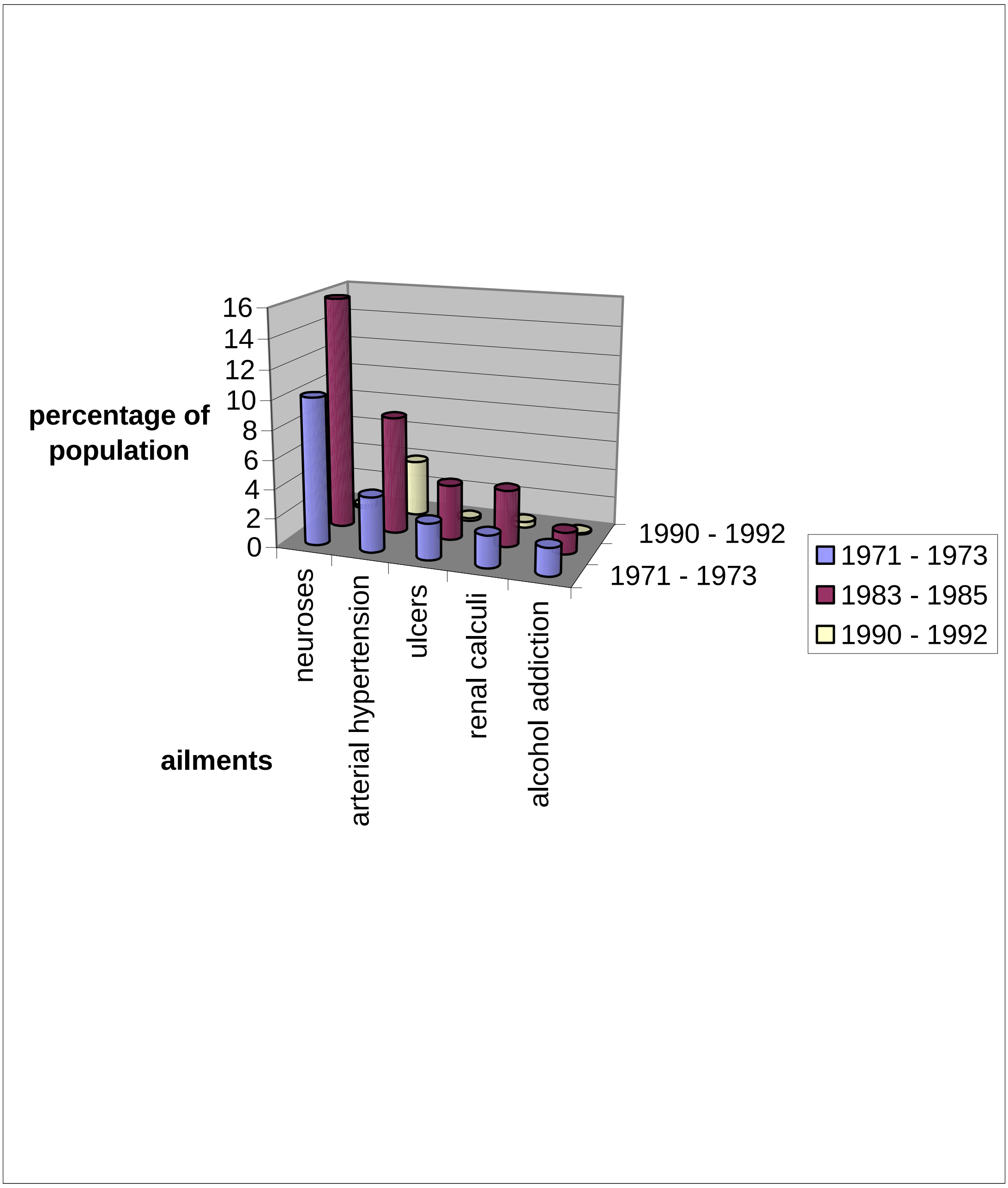
Tables depicting Physical and Psychological states of seafarers.

Table 34. Mortality rate among Danish seamen 1970 – 1985.



(Brandt, L.P.A., Kirk, N.U., Jensen, O.C. & Hansen, H.L., 1994)

Table 35. Health problems of Polish seafarers from 1971 to 1992.



(adapted from Filikowski, 1989)

Table 36. Classification of Human errors in 100 accidents at sea.

Category	Overall Frequency of errors	% age Frequency of total occurrences	Number of accidents in which the errors occur
Cognitive System			
Human information processing	*44*		*35*
Visual illusions	*2*		*2*
False hypothesis	*60*		*51*
Habits	*50*		*46*
Motivation	*1*		*1*
Training	*41*		*35*
Personality	*43*		*35*
Fear	*0*		*0*
Subtotal (%)		*70%*	
Social system			
Social pressure	*20*		*17*
Role	*2*		*2*
Life stress	*2*		*2*
Subtotal (%)		*7%*	
Situational system			
Physical stress	*18*		*12*
Environmental stress	*22*		*17*
Ergonomic aspects	*39*		*34*
Subtotal (%)		*23%*	

(Wagenaar, 1990)

Table 37. Mortality rate among Danish Seamen 1970 – 1985.

Cause of death	Deck Officers %	Deck crew %	Engine officers %	Engine crew %	Reference group %
All causes	*78.2*	*80*	*74.8*	*146.2*	*69.2*
Cancer	*20.6*	*14.8*	*20.7*	*34.5*	*20.4*
Cancer respiratory organs	*7.5*	*4.8*	*9.2*	*18.5*	*7.3*
Cancer digestive organs	*4.7*	*4.6*	*5.7*	*6.7*	*5.9*
Cardiovascular diseases	*23.3*	*19.1*	*21.8*	*38.7*	*27.9*
Ischemic heart diseases	*17.8*	*14.3*	*15.6*	*31.1*	*21.2*
Accidents	*5.7*	*11.9*	*5.7*	*10.9*	*4.3*
Suicide	*4.6*	*7.1*	*4*	*5.9*	*4.3*
Other diseases	*8.5*	*19*	*10.6*	*43.7*	*11.4*
Cirrhosis of the liver	*3*	*5.5*	*2.2*	*9.2*	*1.8*
No information	*15.4*	*8.1*	*12.1*	*12.6*	*0.9*

(Brandt, L.P.A., Kirk, N.U., Jensen, O.C. & Hansen, H.L., 1994)

Table 38. Standardised Mortality ratio (SMR) for liver cirrhosis according to occupation - England and Wales, 1970 - 1972.

Occupation	**SMR**
Average occupation	***100***
Publicans, Innkeepers	***1576***
Deck, Engineering Officers and Pilots, working on ship	***781***
Barmen, Barmaids	***633***
Deck and Engine Room Ratings, Barge and Boatmen	***628***
Fishermen	***595***

(Olkinuora, 1984)

Appendix 4

Participant Information Sheet.

Australian Maritime College

July 7, 1997

Participant Information Sheet.

Dear Survey Participant,

Thank you for agreeing to take part in this survey.

This purpose of this study is to determine the nature of maritime culture, the operational climate within which the industry functions and to determine whether there is a linkage between the above two topics and marine accidents. This study aims to describe maritime culture, maritime climate and those factors that may be involved in marine accidents.

You can help by responding to the instruments as honestly as you can. The responses that you give will be entirely confidential. In addition you will not be asked to reveal any details that may assist in identifying you in any way. The conclusions made after analysing the responses to the instruments will be aggregated and therefore will not identify any particular person. The completed instruments will be kept securely locked for a period of five years at the Australian Maritime College, after which they will be destroyed. The results of the study will form part of a Doctoral thesis.

You do not have to answer any question if you do not wish to. You may withdraw from answering these instruments at any time without prejudice. This letter is only a request for you to participate in this study.

If you have any questions or concerns about participation in this study, please contact any one of the following persons:

Mr Ian P Shea, Lecturer.
Faculty Of MT&E,
Australian Maritime College
P.O. Box 986
Launceston - 7250
Tasmania, Australia

Professor John Williamson, Head.
Department of Secondary and Post compulsory Education.
University of Tasmania
P.O. Box 1214
Launceston - 7250
Tasmania, Australia

You may keep this information sheet for future reference.

Yours sincerely

Ian P Shea

Appendix 5

Assumptions through Metaphor (AtM) Questionnaire.

Assumptions through metaphor (AtM) Questionnaire

Dear Colleague,

Experienced seafarers develop mental images about ships, life aboard them and other seafarers in a general sense. Please indicate the extent you agree or disagree that each of the following twelve metaphors describe your image in this regard.

When you respond to each metaphor please select either of the two descriptions that most nearly describes the image that you have in mind. Please circle (a) <u>or</u> (b) for each item. **Please do not circle both**.

If neither alternative for any item depicts adequately the image that you had, please supply a sentence that does so in the line provided after the (b) alternative in that item.

Thank you for completing the questionnaire.

Ian P Shea.

Australian Maritime College.

Launceston – 7250.

Australia.

Key: **Strongly Disagree (SD)**
Disagree (D)
Undecided (U)
Agree (A)
Strongly Agree (SA)

Ships and life aboard them are `military camps'.

Please circle the response that best fits your view.

SA	A	U	D	SD

A military camp is -

a) a secure compound in which highly trained personnel are prepared to follow orders unquestioningly.

b) an almost jail like institution where people are made to perform tasks that they do not like.

c) ________________________________

Ships and life aboard them are `assembly lines'.

SA	A	U	D	SD

An assembly line is

a) a well planned and conducted system which allows flawless completion of well defined tasks.

b) where people work like automatons governed by regulations that control the work place.

c) ______________________________

Ships and life aboard them are `orchestras'.

SA	A	U	D	SD

An orchestra is

a) a collection of musicians regimented by a conductor to reproduce a composer's musical score.

b) a collection of dedicated people united together to create harmonious outcomes.

c) ______________________________

Ships and life aboard them are `herds'.

SA	A	U	D	SD

A herd is

a) a group of beings that mindlessly follow a single being.

b) A group of beings that live as a mutual support community, and are united by a common set of values.

c) ________________________________

Ships and life aboard them are` teams'.

SA	A	U	D	SD

A team is

a) a collection of people who actively share ideas or strategies in order to act collectively to achieve a certain goal.

b) a group of people that are directed by a single person to go in a certain direction or perform a job.

c) ________________________________

Ships and life aboard them are `beehives'.

SA	A	U	D	SD

A beehive is

a) a place where members actively strive for a common good.

b) a place where an enormous amount of mindless programmed activity takes place with little substance to show for it.

c) ________________________________

Ships and life aboard them are `ghettos'.

SA	A	U	D	SD

A ghetto is

a) an area where inhabitants feel they have a great deal in common with each other and are able to share in the mutual support system that exists.

b) an area where a minority group of people are herded together in order to ensure that they do not mix with other members of society.

c) ________________________________

Ships and life aboard them are `forums'.

SA	A	U	D	SD

A forum is

a) a platform that people use to air their grievances.

b) a place where numerous fruitful discussions take place.

c) ________________________________

Heads of department aboard ships are `expeditionists'.

SA	A	U	D	SD

An expeditionist is

a) a person who directs others to follow a certain path.

b) a person who assists others to pursue a common mission.

c) ________________________________

Heads of department aboard ships are `at the helm'.

SA	A	U	D	SD

A person `at the helm' is

a) one who receives directions from another to achieve a goal.

b) a person in charge of a situation, and who leads by example.

4. ________________________________

Heads of department aboard ships are `Pied pipers'.

SA	A	U	D	SD

A `Pied Piper' is

a) a skilled person leading a group of less experienced people.

b) a conniving person who steals mindless followers away.

c) ________________________________

Heads of department aboard ships are `aerobics instructors'.

SA	A	U	D	SD

An `aerobics instructor' is

a) a task master who being essentially an exhibitionist displays his or her superior skills.

b) a person who gets a group of people to perform an activity by demonstrating it to them

c) ________________________________

Appendix 6

Analysis of the AtM instrument

6.1.1 Analysis of the AtM Instrument

As only the 'Team' metaphor satisfied the criteria, descriptive statistics were obtained only for this item. For 'Factor 1'or those responses that defined team using the positively worded definition. The skewness is positive while the responses are leptokurtic (Statview, 1992). This indicated that the responses are congregated near the central tendency of the distribution. The standard deviation in this case is 0.97 or slightly less than 1.

Table 39. Frequency distribution table for the 'Team' metaphor.

	Factor	**1**	**Factor**	**2**	**Factor**	**3**
Valid	**Freq**	**%age**	**Freq**	**%age**	**Freq**	**%age**
1.00	*116*	*25.8*	*18*	*12.1*	*16*	*13.7*
2.00	*257*	*57.1*	*103*	*69.1*	*44*	*37.6*
3.00	*33*	*7.3*	*10*	*6.7*	*32*	*27.4*
4.00	*25*	*5.6*	*17*	*11.4*	*22*	*18.8*
5.00	*19*	*4.2*	*1*	*0.7*	*3*	*2.6*

For 'Factor 2' or those responses that define 'Team' using the negative definition. The skewness is positive and the responses are leptokurtic (Statview, 1992), the standard deviation in this case is 0.819. The bulk of the responses therefore congregate around the central tendency for this category as well.

Table 40. Descriptive statistics for 'Team' metaphor.

Statistics	**Factor = 1 n= 450 (62.9%)**	**Factor = 2, n= 149 (20.8%)**	**Factor = 3 n= 117 (16.3%)**
Mean	*2.053*	*2.195*	*2.590*
Median	*2.000*	*2.000*	*2.000*
Mode	*2.000*	*2.000*	*2.000*
Std Deviation	*0.966*	*0.819*	*1.027*
Skewness	*0.115*	*1.194*	*0.264*
Kurtosis	*2.069*	*1.365*	*-0.656*

For ‘Factor 3’ the skewness is positive while the responses are platykurtic (Statview, 1992). This indicates that there are many values in the tails of distribution, indicating a lack of agreement.

This is consistent with the category, as it is here that individuals provide their own definitions for the metaphors. A lack of agreement could therefore be expected.

From the above there is strong agreement that the metaphor ‘Team’ would represent ships and life aboard them. There is also strong agreement that the positively worded definition (a), is the broadly accepted meaning seafarers attach to it.

Table 41. Frequency distribution Table for the ‘Military camp’ metaphor.

Item	Responses	Results
Criterion 1	*38.7%*	#
Criterion 2	*49.2%*	#
Criterion 3	*48.9% (1)*	#
Criterion 4	*12.2%*	+
Criterion 5	*All five categories*	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

It is evident from Table 95 that there was no clear consensus of opinion on whether or not the metaphor ‘Military camp’ was an appropriate descriptor for life at sea and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

It is evident from Table 96 that there was no clear consensus on whether or not the metaphor ‘Assembly line’ was an appropriate descriptor for life at sea and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 42. Frequency distribution table for the 'Assembly line' metaphor.

Item	Responses	Results
Criterion 1	*50.7%*	#
Criterion 2	*33.4%*	#
Criterion 3	*46.8% (1)*	#
Criterion 4	*15.9%*	+
Criterion 5	*All five categories*	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

It is evident from Table 97 that there was no clear consensus on whether or not the metaphor 'Orchestra' was an appropriate descriptor for life at sea and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 43. Frequency distribution table for the 'Orchestra' metaphor.

Item	Responses	Results
Criterion 1	*50.0%*	#
Criterion 2	*27.8%*	#
Criterion 3	*60.6% (2)*	#
Criterion 4	*22.1%*	+
Criterion 5	*All five categories*	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

It is evident from Table 98 there was no consensus of opinion on whether or not the metaphor 'Herd' was an appropriate descriptor for life at sea and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 44. Frequency distribution table for the 'Herd' metaphor.

Item	Responses	Results
Criterion 1	*44.3%*	#
Criterion 2	*36.7%*	#
Criterion 3	*63.2% (2)*	#
Criterion 4	*19.0%*	+
Criterion 5	*All five categories*	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

It is evident from Table 99 there was no consensus of opinion on whether or not the metaphor 'Beehives' was an appropriate descriptor for life at sea and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 45. Frequency distribution table for the 'Beehives' metaphor.

Item	Responses	Results
Criterion 1	*65.3%*	#
Criterion 2	*24.9%*	#
Criterion 3	*65.7% (1)*	#
Criterion 4	*24.4%*	+
Criterion 5	*All five categories*	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

It is evident from Table 100 there was no consensus of opinion on whether or not the metaphor 'Ghettos' was an appropriate descriptor for life at sea and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 46. Frequency distribution table for the 'Ghetto' metaphor.

Item	Responses	Results
Criterion 1	*38.5%*	#
Criterion 2	*35.8%*	#
Criterion 3	*62.0% (1)*	#
Criterion 4	*25.7%*	+
Criterion 5	*All five categories*	+
Key:- # = fails to meet requirements, + = meets requirements		

It is evident from Table 101 there was no consensus of opinion on whether or not the metaphor 'Forum' was an appropriate descriptor for life at sea and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 47. Frequency distribution table for the 'Forum' metaphor.

Item	Responses	Results
Criterion 1	*47.2%*	#
Criterion 2	*25.4%*	#
Criterion 3	*67.2% (2)*	+
Criterion 4	*27.2%*	+
Criterion 5	*All five categories*	+
Key:- # = fails to meet requirements, + = meets requirements		

It is evident from Table 102 there was no consensus of opinion on whether or not the metaphor 'Expeditionist' was an appropriate descriptor for a Head of Department and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 48. Frequency distribution table for the 'Expeditionist' metaphor.

Item	Responses	Results
Criterion 1	*60.8%*	#
Criterion 2	*17.6%*	#
Criterion 3	*49.4% (2)*	#
Criterion 4	*21.4%*	+
Criterion 5	**All five categories**	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

It is evident from Table 103 that there was no consensus of opinion on whether or not the metaphor 'At the helm' was an appropriate descriptor for a Head of Department and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 49. Frequency distribution table for the 'At the helm' metaphor.

Item	Responses	Results
Criterion 1	*70.1%*	+
Criterion 2	*11.0%*	#
Criterion 3	*56.6% (2)*	#
Criterion 4	*18.4%*	+
Criterion 5	*All five categories*	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

It is evident from Table 104 there was no consensus of opinion on whether or not the metaphor 'Pied Piper' was an appropriate descriptor for a Head of Department and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 50. Frequency distribution table for the 'Pied Piper' metaphor.

Item	Responses	Results
Criterion 1	*46.4%*	#
Criterion 2	*29.7%*	#
Criterion 3	*73.8% (1)*	+
Criterion 4	*23.9%*	+
Criterion 5	*All five categories*	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

It is evident from Table 105 there was no consensus of opinion on whether or not the metaphor 'Aerobics Instructor' was an appropriate descriptor for a Head of Department and what its meaning should be. This metaphor therefore failed to meet the specified criteria and was eliminated from further analysis.

Table 51. Frequency distribution table for the 'Aerobics Instructor' metaphor.

Item	Responses	Results
Criterion 1	*48.9%*	#
Criterion 2	*26.4%*	#
Criterion 3	*63.4% (2)*	#
Criterion 4	*12.2%*	#
Criterion 5	*All five categories*	+
Key:- **# = fails to meet requirements,** **+ = meets requirements**		

Table 52. Factor loading for ISMA items.

Factor label	ISMA item	1	2	3	4	5	6
Cooperation	**Family**	*0.62*					
	Forum	*0.57*					
	Team	*0.79*					
	Negotiating area	*0.68*					
Suppression	**Herd**		*0.73*				
	Mental strait jacket		*0.49*				
	Military camp		*0.49*				
	Ghetto		*0.43*				
	Creche		*0.61*				
	Machine		*0.85*				
	Prison		*0.56*				
Constrained	**Beehive**			*0.62*			
	Living organism			*0.69*			
	Theatre			*0.62*			
Celebration	**Culture**				*0.73*		
	Exhibition				*0.70*		
Focused	**Orchestra**					*0.44*	
	Artist's palette					*0.54*	
	Expedition					*0.65*	
	Shopping mall					*0.62*	
Basic needs	**Hospital**						*0.80*
	Labour ward						*0.68*

Note: The only items included are those with factor loading of at least 0.40 on one factor and less than 0.40 on all other factors (Grady, 1996).

Table 53. Factor loading for AtM items.

AtM Item	Component 1	Component 2	Component 3
Orchestra	*.42*		
Team	*.78*		
Expeditionist	*.62*		
at the helm	*.79*		
Aerobic instructor	*.37*		
Military Camp		*.80*	
Assembly line		*.74*	
Herd		*.58*	
Beehive			*.45*
Ghetto			*.64*
Forum			*.81*
Pied piper			*.50*

Table 54. Discriminant validity and reliability estimates for ISMA factors.

Factor	Mean correlation with other factors	Alpha reliability coefficients
1	***0.33***	***0.72***
2	***-0.01***	***0.77***
3	***0.36***	***0.56***
4	***0.26***	***0.50***
5	***0.51***	***0.63***
6	***0.17***	***0.72***

Appendix 7

Maritime Culture Questionnaire.

Maritime Culture Questionnaire.

Dear Respondent,

This questionnaire describes some scenarios about your last ship. Please read each item and state whether you **Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), Strongly agree (SA)** with each of them. Circle the one that best represents your view.

All the information you give will be kept confidential and no data will be presented in a form to identify individuals, particular ships or nationalities.

Please also fill in some details of yourself and your last ship:

Nationality of your last ship: ________________________________

To which department do you belong Deck Officer / Engineering Officer / Rating.

Size in tonnes of your last ship:__________________ DWT *(The size should be to the nearest 1000 tonnes)*

How many persons were employed on board:__________________

How many months did you spend on board:__________________

How long does a person normally spend on board:______________

Do you find your job: Interesting / Complex / Repetitive / Simple *(You may circle more than one of the above)*

Did any accidents occur on board ship while you were there? YES / NO

If you answered 'Yes; to the above, (circle the appropriate response) were they a COLLISION (between two vessels) / GROUNDING / STRANDING / FIRE / CONTACT (between vessel and stationary object) / INJURY TO PERSON / OTHER (PLEASE EXPLAIN)

Thank you for completing this questionnaire.

Ian P Shea.

Australian Maritime College.

Launceston – 7250.

Australia.

Maritime Culture questionnaire.

Key: Strongly Disagree (SD)
Disagree (D)
Undecided (U)
Agree (A)
Strongly Agree (SA)

1. **Observable behaviour**					
1. The ship was very organised and the heads of department supervised each aspect of the ship's work closely. They did this to help people do their jobs well and improve crew morale.	SD	D	U	A	SA
2. Ideas about the work to be done were discussed frequently within the department but solutions that did not concur with those proposed by the head of department were not accepted.	SD	D	U	A	SA
3. The heads of department met frequently with all members of their department to discuss problems and to praise members who had done well.	SD	D	U	A	SA
4. People learned what to do by imitating the behaviour of the head of department. They also learned from non-verbal signals by them that discussion and criticism were frowned upon.	SD	D	U	A	SA

5. The head of department usually demonstrated by personal example how things were to be done, but generally encouraged discussion and criticism of the procedures.	SD	D	U	A	SA
6. Duties were highly structured with everything set out explicitly. Deviation from the laid down procedures were frowned upon and the person concerned penalised.	SD	D	U	A	SA

2. Values

1. The crew and officers believed that all rules and regulations prescribed on the ship were meant for the good of the ship and benefited them as well.	SD	D	U	A	SA
2. Most members thought that the demonstrations provided by the head of department were of little or no value, as thereafter the same person would constantly criticise and demean them when they did the same job.	SD	D	U	A	SA
3. Members of the ship valued their head of department's efforts to seek their opinions in order to run the department efficiently.	SD	D	U	A	SA

4. Most members believed that the endless discussions were futile as the head only accepted a solution that conformed with that person's pre-arrived at outcome.	SD	D	U	A	SA
5. The members thought highly of their head of department as that person not only prescribed a job but did it as well to show everyone the outcome required.	SD	D	U	A	SA
6. The members of the department thought that all the rules prescribed by the department were useless as the head never ever bothered to check whether anyone complied with them or not.	SD	D	U	A	SA

Appendix 8

Maritime Climate Questionnaire.

Maritime Climate Questionnaire.

Dear Respondent,

Thank you for agreeing to participate in this survey.

The questionnaire that you are about to complete, asks you about some aspects of the job on your last ship. Your possible replies to each statement range from **Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), Strongly Agree (SA)**. Please circle the most appropriate response best reflects your view.

Yours sincerely,

Ian P Shea.

Australian Maritime College.

Launceston – 7250.

Australia.

Maritime Climate Questionnaire.

Key: **Strongly Disagree (SD)**
Disagree (D)
Undecided (U)
Agree (A)
Strongly Agree (SA)

The large amount of attention that I pay towards doing a good job on the ship is a source of pride to me.	SD	D	U	A	SA
1. My superiors support and encourage me in my efforts on the ship.	SD	D	U	A	SA
2. The members of my ship are a closely-knit team that support each other.	SD	D	U	A	SA
3. I am afraid to express my opinions in front of my superiors.	SD	D	U	A	SA
4. I am allowed complete freedom in the conduct of my work.	SD	D	U	A	SA
5. My superiors encourage us to plan and devise efficient methods for working on the ship.	SD	D	U	A	SA
6. The rules form a large part of our life on the ship as our superiors use them as a form of supervision.	SD	D	U	A	SA
7. When on the job I know exactly what to do as my superiors have made the routine very clear to me.	SD	D	U	A	SA
8. I am allowed to modify the routines of a job if I feel so inclined.	SD	D	U	A	SA
9. The structure and fittings make it a	SD	D	U	A	SA

joy for me to work on the ship.					
10. The repercussions of poor performance are always at the back of my mind when I work on ship.	SD	D	U	A	SA
11. I set high performance standards for myself when working on board the ship.	SD	D	U	A	SA
12. The leaders of my ship take every opportunity to praise me if I do a good job.	SD	D	U	A	SA
13. All my ship-mates are eager to help and assist me if I need it.	SD	D	U	A	SA
14. I express my opinions freely amongst my colleagues on the ship.	SD	D	U	A	SA
15. My superiors allow me to take whatever decisions are necessary to successfully do my job.	SD	D	U	A	SA
16. The hallmark of a "job well done" on my ship is when it has been planned and executed efficiently.	SD	D	U	A	SA
17. Rules and regulations are meant for our own good as our superiors always refer to them when supervising our work.	SD	D	U	A	SA
18. Most of the daily routine jobs on the ship are stress free as I know exactly what to do.	SD	D	U	A	SA
19. I am allowed to modify the routines of some jobs, but not others.	SD	D	U	A	SA

20. I prefer working outside the accommodation as I feel the fittings within it do not permit me to work efficiently.	SD	D	U	A	SA
21. The main topic of discussion on board during leisure hours is about work.	SD	D	U	A	SA
22. I go through the motions of doing a job, but most of my superiors think that I am a good worker.	SD	D	U	A	SA
23. No matter what I do on board the ship I am never encouraged or praised.	SD	D	U	A	SA
24. If I make a mistake I dare not tell any of my shipmates as they will surely report it to my superiors.	SD	D	U	A	SA
25. I am not afraid to express my opinions to anyone on the ship.	SD	D	U	A	SA
26. When I perform a job it must be exactly by the book with no room for interpretation.	SD	D	U	A	SA
27. Nobody checks if a job is well done or not, my superiors just expect me to accomplish my tasks with the minimum amount of fuss.	SD	D	U	A	SA
28. There are rules for everything on board and my superiors can invent a few if they think it is necessary to keep me in my place.	SD	D	U	A	SA

29. Working on board is sometimes quite frustrating as no one tells you how to do a job, but if you do it wrong everyone has something to say about it.	SD	D	U	A	SA
30. There is only one way to do things on board, and that is the way it always has been done.	SD	D	U	A	SA
31. My ship's accommodation is like a five star hotel; it is very satisfying working in such surroundings.	SD	D	U	A	SA
32. You are expected to be available on call 24 hours a day even if you have been working all day.	SD	D	U	A	SA
33. Performing to my own high standards gives me great satisfaction.	SD	D	U	A	SA
34. My superiors have created such a supportive atmosphere on board, that I always want to do my best.	SD	D	U	A	SA
35. The support of my shipmates helps me to overcome problems that I sometimes have difficulty solving alone.	SD	D	U	A	SA
36. The atmosphere on the ship is such that the expression of any opinion is not misinterpreted in a negative way.	SD	D	U	A	SA

37. My superiors regard complete autonomy of function as a pre-requisite to smooth and efficient ship operations.	SD	D	U	A	SA
38. Pre-planning in all jobs is a culture our superiors actively cultivate on board the ship.	SD	D	U	A	SA
39. We are an over-regulated industry but our superiors interpret the rules in a way that allows for the smooth functioning of the ship.	SD	D	U	A	SA
40. Most of our days pass smoothly as everyone knows exactly what and how to perform their tasks.	SD	D	U	A	SA
41. Experimentation and innovative ways of doing a job more efficiently is encouraged by my superiors.	SD	D	U	A	SA
42. The accommodation of my ship is so designed as to encourage the efficient performance of my duties.	SD	D	U	A	SA
43. We are expected to perform at peak efficiency at all times, regardless of the time of day.	SD	D	U	A	SA

Thank you for your assistance.

Appendix 9

Analysis of the MClQ instrument.

Table 55. Comparison of coefficient alpha values of MCIQ wih other similar studies.

Scale	Unit of Analysis	Moos (1974)	Science teachers (1983)	Fisher, Docker & Fraser (1986)	MCIQ
Involvement	*Individual*	*0.85*	*0.85*	*0.76*	*0.60*
Peer Cohesion	*Individual*	*0.70*	*0.60*	*0.72*	*0.59*
Supervisor Support	*Individual*	*0.78*	*0.66*	*0.71*	*0.72*
Expressiveness	*Individual*	-	-	-	*0.56*
Autonomy	*Individual*	*0.76*	*0.61*	*0.60*	*0.52*
Task Orientation	*Individual*	*0.78*	*0.78*	*0.70*	*0.59*
Work Pressure	*Individual*	*0.84*	*0.74*	*0.79*	*0.49*
Clarity	*Individual*	*0.82*	*0.73*	*0.70*	*0.51*
Staff Supervision	*Individual*	*0.77*	*0.64*	*0.64*	*0.39*
Innovation	*Individual*	*0.91*	*0.84*	*0.84*	*0.51*
Physical comfort	*Individual*	*0.83*	*0.70*	*0.71*	*0.67*
Sample size	*Individual*	**624**	**114**	**599**	**710**

Table 56. Correlations for the Involvement Scale.

Item		Question 1	Question 12	Question 23	Question 34
Question 1	Pearson Correlation	*1.000*	*.297(**)*	*-.113(**)*	*.311(**)*
	Sig. (2-tailed)		*.000*	*.003*	*.000*
	N	*710*	*710*	*710*	*710*
Question 12	Pearson Correlation	*.297(**)*	*1.000*	*-.075(*)*	*.408(**)*
	Sig. (2-tailed)	*.000*		*.045*	*.000*
	N	*710*	*710*	*710*	*710*
Question 23	Pearson Correlation	*-.113(**)*	*-.075(*)*	*1.000*	*-.034*
	Sig. (2-tailed)	*.003*	*.045*		*.360*
	N	*710*	*710*	*710*	*710*
Question 34	Pearson Correlation	*.311(**)*	*.408(**)*	*-.034*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.360*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					
** Correlation is significant at the 0.05 level (2-tailed).*					

Table 57. Correlations for the Peer Cohesion Scale.

Item		Question 3	Question 13	Question 25	Question 36
Question 3	Pearson Correlation	*1.000*	*.335(**)*	*.142(**)*	*.341(**)*
	Sig. (2-tailed)		*.000*	*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 13	Pearson Correlation	*.335(**)*	*1.000*	*.060*	*.304(**)*
	Sig. (2-tailed)	*.000*		*.112*	*.000*
	N	*710*	*710*	*710*	*710*
Question 25	Pearson Correlation	*.142(**)*	*.060*	*1.000*	*.258(**)*
	Sig. (2-tailed)	*.000*	*.112*		*.000*
	N	*710*	*710*	*710*	*710*
Question 36	Pearson Correlation	*.341(**)*	*.304(**)*	*.258(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 58. Correlations for the Supervisor Support Scale.

Item		Question 2	Question 13	Question 24	Question 35
Question 2	Pearson Correlation	*1.000*	*.472(**)*	*.345(**)*	*.461(**)*
	Sig. (2-tailed)		*.000*	*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 13	Pearson Correlation	*.472(**)*	*1.000*	*.320(**)*	*.525(**)*
	Sig. (2-tailed)	*.000*		*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 24	Pearson Correlation	*.345(**)*	*.320(**)*	*1.000*	*.232(**)*
	Sig. (2-tailed)	*.000*	*.000*		*.000*
	N	*710*	*710*	*710*	*710*
Question 35	Pearson Correlation	*.461(**)*	*.525(**)*	*.232(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 59. Correlations for the Task Orientation Scale.

Item		Question 6	Question 17	Question 28	Question 39
Question 6	Pearson Correlation	*1.000*	*.316(**)*	*.170(**)*	*.373(**)*
	Sig. (2-tailed)		*.000*	*.000*	*.000*
	N	*708*	*708*	*708*	*708*
Question 17	Pearson Correlation	*.316(**)*	*1.000*	*.173(**)*	*.271(**)*
	Sig. (2-tailed)	*.000*		*.000*	*.000*
	N	*708*	*710*	*710*	*710*
Question 28	Pearson Correlation	*.170(**)*	*.173(**)*	*1.000*	*.240(**)*
	Sig. (2-tailed)	*.000*	*.000*		*.000*
	N	*708*	*710*	*710*	*710*
Question 39	Pearson Correlation	*.373(**)*	*.271(**)*	*.240(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.000*	
	N	*708*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 60. Correlations for the Physical Comfort Scale.

Item		Question 10	Question 21	Question 32	Question 43
Question 10	Pearson Correlation	*1.000*	*-.047*	*.345(**)*	*.335(**)*
	Sig. (2-tailed)		*.207*	*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 21	Pearson Correlation	*-.047*	*1.000*	*.053*	*.012*
	Sig. (2-tailed)	*.207*		*.160*	*.758*
	N	*710*	*710*	*710*	*710*
Question 32	Pearson Correlation	*.345(**)*	*.053*	*1.000*	*.524(**)*
	Sig. (2-tailed)	*.000*	*.160*		*.000*
	N	*710*	*710*	*710*	*710*
Question 43	Pearson Correlation	*.335(**)*	*.012*	*.524(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.758*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 61. Correlations for the Clarity Scale.

Item		Question 8	Question 19	Question 30	Question 41
Question 8	Pearson Correlation	*1.000*	*.165(**)*	*.196(**)*	*.328(**)*
	Sig. (2-tailed)		*.000*	*.000*	*.000*
	N	*709*	*709*	*709*	*709*
Question 19	Pearson Correlation	*.165(**)*	*1.000*	*.166(**)*	*.288(**)*
	Sig. (2-tailed)	*.000*		*.000*	*.000*
	N	*709*	*710*	*710*	*710*
Question 30	Pearson Correlation	*.196(**)*	*.166(**)*	*1.000*	*.154(**)*
	Sig. (2-tailed)	*.000*	*.000*		*.000*
	N	*709*	*710*	*710*	*710*
Question 41	Pearson Correlation	*.328(**)*	*.288(**)*	*.154(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.000*	
	N	*709*	*710*	*710*	*710*

*** Correlation is significant at the 0.01 level (2-tailed).*

Table 62. Correlations for the Autonomy Scale.

Item		Question 5	Question 16	Question 27	Question 38
Question 5	Pearson Correlation	*1.000*	*.404(**)*	*.016*	*.190(**)*
	Sig. (2-tailed)		*.000*	*.669*	*.000*
	N	*710*	*710*	*710*	*710*
Question 16	Pearson Correlation	*.404(**)*	*1.000*	*-.019*	*.181(**)*
	Sig. (2-tailed)	*.000*		*.616*	*.000*
	N	*710*	*710*	*710*	*710*
Question 27	Pearson Correlation	*.016*	*-.019*	*1.000*	*.121(**)*
	Sig. (2-tailed)	*.669*	*.616*		*.001*
	N	*710*	*710*	*710*	*710*
Question 38	Pearson Correlation	*.190(**)*	*.181(**)*	*.121(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.001*	
	N	*710*	*710*	*710*	*710*

*** Correlation is significant at the 0.01 level (2-tailed).*

Table 63. Correlations for the Expressiveness Scale.

Item		Question 4	Question 15	Question 26	Question 37
Question 4	Pearson Correlation	*1.000*	*.243(**)*	*.270(**)*	*.185(**)*
	Sig. (2-tailed)		*.000*	*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 15	Pearson Correlation	*.243(**)*	*1.000*	*.334(**)*	*.202(**)*
	Sig. (2-tailed)	*.000*		*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 26	Pearson Correlation	*.270(**)*	*.334(**)*	*1.000*	*.229(**)*
	Sig. (2-tailed)	*.000*	*.000*		*.000*
	N	*710*	*710*	*710*	*710*
Question 37	Pearson Correlation	*.185(**)*	*.202(**)*	*.229(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 64. Correlations for the Innovation Scale.

Item		Question 9	Question 20	Question 31	Question 42
Question 9	Pearson Correlation	*1.000*	*.256(**)*	*.163(**)*	*.295(**)*
	Sig. (2-tailed)		*.000*	*.003*	*.000*
	N	*710*	*710*	*710*	*710*
Question 20	Pearson Correlation	*.256(**)*	*1.000*	*.024*	*.175(**)*
	Sig. (2-tailed)	*.000*		*.521*	*.000*
	N	*710*	*710*	*710*	*710*
Question 31	Pearson Correlation	*.163(**)*	*.024*	*1.000*	*.151(**)*
	Sig. (2-tailed)	*.000*	*.521*		*.000*
	N	*710*	*710*	*710*	*710*
Question 42	Pearson Correlation	*.295(**)*	*.175(**)*	*.151(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 65. Correlations for the Staff Supervision Scale.

Item		Question 7	Question 18	Question 29	Question 40
Question 7	Pearson Correlation	*1.000*	*.226(**)*	*.079(*)*	*.115(**)*
	Sig. (2-tailed)		*.000*	*.035*	*.002*
	N	*710*	*710*	*710*	*710*
Question 18	Pearson Correlation	*.226(**)*	*1.000*	*.028*	*.186(**)*
	Sig. (2-tailed)	*.000*		*.449*	*.000*
	N	*710*	*710*	*710*	*710*
Question 29	Pearson Correlation	*.079(*)*	*.028*	*1.000*	*.020*
	Sig. (2-tailed)	*.035*	*.449*		*.587*
	N	*710*	*710*	*710*	*710*
Question 40	Pearson Correlation	*.115(**)*	*.186(**)*	*.020*	*1.000*
	Sig. (2-tailed)	*.002*	*.000*	*.587*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					
** Correlation is significant at the 0.05 level (2-tailed).*					

Table 66. Correlations for the Work Pressure Scale.

Item		Question 11	Question 22	Question 33	Question 44
Question 11	Pearson Correlation	*1.000*	*.012*	*.052*	*.100(**)*
	Sig. (2-tailed)		*.747*	*.168*	*.008*
	N	*710*	*710*	*710*	*710*
Question 22	Pearson Correlation	*.012*	*1.000*	*.116(**)*	*.046*
	Sig. (2-tailed)	*.747*		*.002*	*.225*
	N	*710*	*710*	*710*	*710*
Question 33	Pearson Correlation	*.052*	*.116(**)*	*1.000*	*.325(**)*
	Sig. (2-tailed)	*.168*	*.002*		*.000*
	N	*710*	*710*	*710*	*710*
Question 44	Pearson Correlation	*.100(**)*	*.046*	*.325(**)*	*1.000*
	Sig. (2-tailed)	*.008*	*.225*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 67. Descriptive Statistics for the MCIQ Instrument (1).

Item	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Question 1	4.2	4.0	4.0	0.80	-1.66	3.10
Question 2	3.8	4.0	4.0	0.94	-1.03	0.33
Question 3	3.6	4.0	4.0	0.99	-0.83	-0.17
Question 4	2.2	4.0	4.0	1.04	-0.99	0.22
Question 5	3.8	4.0	4.0	-0.94	-0.26	-1.03
Question 6	3.3	4.0	4.0	-0.30	-0.73	0.14
Question 7	3.7	4.0	4.0	-0.85	-0.31	-0.30
Question 8	3.6	4.0	4.0	-0.58	-0.36	0.12
Question 9	3.6	4.0	4.0	-0.84	0.12	-0.55
Question 10	3.4	3.0	4.0	1.12	-0.28	-0.91
Question 11	3.1	4.0	4.0	1.08	-0.44	-0.77
Question 12	3.4	4.0	4.0	0.76	-1.14	2.21
Question 13	4.1	3.0	4.0	1.09	-0.32	-0.83
Question 14	3.2	4.0	4.0	1.01	-0.77	-0.05
Question 15	3.6	4.0	4.0	0.88	-1.06	0.92
Question 16	3.8	4.0	4.0	0.97	-0.69	-0.33
Question 17	3.6	4.0	4.0	0.81	-1.25	2.38
Question1 8	3.9	4.0	4.0	0.89	-0.81	0.40
Question 19	3.8	4.0	4.0	1.10	-0.44	-0.90
Question 20	3.4	4.0	4.0	0.91	-0.88	-0.16
Question 21	2.5	3.0	2.0	1.02	0.31	-0.69
Question 22	3.5	3.0	2.0	1.17	0.24	-1.09
Question2 3	3.3	3.0	2.0	1.02	0.28	-0.85
Question 24	2.7	4.0	4.0	1.05	-0.67	-0.33
Question2 5	2.9	4.0	4.0	0.96	-1.09	0.91

Table 68. Descriptive Statistics for the MCIQ Instrument (2).

Item	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Question2 6	3.2	4.0	4.0	1.09	-0.73	-0.34
Question 27	2.8	2.0	2.0	0.97	0.53	-0.51
Question 28	3.3	4.0	4.0	1.12	-0.24	-1.12
Question 29	3.2	3.5	4.0	1.06	-0.29	-1.02
Question 30	2.8	3.0	2.0	1.21	0.13	-1.20
Question 31	3.2	4.0	4.0	1.14	-0.30	-1.07
Question 3 2	2.4	2.0	2.0	1.12	0.62	-0.47
Question 33	3.8	4.0	4.0	1.09	-0.97	0.15
Question 34	4.2	4.0	4.0	0.74	-1.17	2.74
Question 35	3.4	4.0	4.0	1.04	-0.45	-0.58
Question 36	3.7	4.0	4.0	0.84	-1.12	1.18
Question 37	3.2	3.0	4.0	0.95	-0.45	-0.76
Question 38	3.3	3.0	4.0	0.84	-0.37	-0.28
Question3 9	3.7	4.0	4.0	0.91	-0.83	0.20
Question 40	3.5	4.0	4.0	0.91	-0.71	0.00
Question 41	3.7	4.0	4.0	0.95	-1.01	0.44
Question 42	3.4	4.0	4.0	0.99	-0.56	-0.52
Question 43	3.0	3.0	4.0	1.05	-0.17	-0.95
Question 44	3.8	4.0	4.0	0.95	-0.81	0.13

Table 69. Correlations for the Involvement Section.

Item		Question 1	Question 12	Question 23	Question 34
Question 1	Pearson Correlation	1.000	.297(**)	-.113(**)	.311(**)
	Sig. (2-tailed		.000	.003	.000
	N	710	710	710	710
Question 12	Pearson Correlation	.297(**)	1.000	-.075(*)	.408(**)
	Sig. (2-tailed	.000		.045	.000
	N	710	710	710	710
Question 23	Pearson Correlation	-.113(**)	-.075(*)	1.000	-.034
	Sig. (2-tailed	.003	.045		.360
	N	710	710	710	710
Question 34	Pearson Correlation	.311(**)	.408(**)	-.034	1.000
	Sig. (2-tailed	.000	.000	.360	
	N	710	710	710	710
** Correlation is significant at the 0.01 level (2-tailed).					
* Correlation is significant at the 0.05 level (2-tailed).					

Table 70. Correlations for the Peer Cohesion Section.

Item		Question 3	Question 13	Question 25	Question 36
Question 3	Pearson Correlation	*1.000*	*.335(**)*	*.142(**)*	*.341(**)*
	Sig. (2-tailed		*.000*	*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 13	Pearson Correlation	*.335(**)*	*1.000*	*.060*	*.304(**)*
	Sig. (2-tailed	*.000*		*.112*	*.000*
	N	*710*	*710*	*710*	*710*
Question 25	Pearson Correlation	*.142(**)*	*.060*	*1.000*	*.258(**)*
	Sig. (2-tailed	*.000*	*.112*		*.000*
	N	*710*	*710*	*710*	*710*
Question 36	Pearson Correlation	*.341(**)*	*.304(**)*	*.258(**)*	*1.000*
	Sig. (2-tailed	*.000*	*.000*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 71. Correlations for the Supervisor Support Section.

Item		Question 2	Question 13	Question 24	Question 35
Question 2	Pearson Correlation	*1.000*	*.472 (**)*	*.345 (**)*	*.461 (**)*
	Sig. (2-tailed		*.000*	*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 13	Pearson Correlation	*.472(**)*	*1.000*	*.320 (**)*	*.525 (**)*
	Sig. (2-tailed	*.000*		*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 24	Pearson Correlation	*.345(**)*	*.320 (**)*	*1.000*	*.232(**)*
	Sig. (2-tailed	*.000*	*.000*		*.000*
	N	*710*	*710*	*710*	*710*
Question 35	Pearson Correlation	*.461 (**)*	*.525 (**)*	*.232 (**)*	*1.000*
	Sig. (2-tailed	*.000*	*.000*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 72. Correlations for the Task Orientation Section.

Item		Question 6	Question 17	Question 28	Question 39
Question 6	Pearson Correlation	*1.000*	*.316(**)*	*.170(**)*	*.373(**)*
	Sig. (2-tailed)		*.000*	*.000*	*.000*
	N	*708*	*708*	*708*	*708*
Question 17	Pearson Correlation	*.316(**)*	*1.000*	*.173(**)*	*.271(**)*
	Sig. (2-tailed)	*.000*		*.000*	*.000*
	N	*708*	*710*	*710*	*710*
Question 28	Pearson Correlation	*.170(**)*	*.173(**)*	*1.000*	*.240(**)*
	Sig. (2-tailed)	*.000*	*.000*		*.000*
	N	*708*	*710*	*710*	*710*
Question 39	Pearson Correlation	*.373(**)*	*.271(**)*	*.240(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.000*	*.000*	
	N	*708*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 73. Correlations for the Physical Comfort Section.

Item		Question 10	Question 21	Question 32	Question 43
Question 10	Pearson Correlation	*1.000*	*-.047*	*.345(**)*	*.335(**)*
	Sig. (2-tailed)		*.207*	*.000*	*.000*
	N	*710*	*710*	*710*	*710*
Question 21	Pearson Correlation	*-.047*	*1.000*	*.053*	*.012*
	Sig. (2-tailed)	*.207*		*.160*	*.758*
	N	*710*	*710*	*710*	*710*
Question 32	Pearson Correlation	*.345(**)*	*.053*	*1.000*	*.524(**)*
	Sig. (2-tailed)	*.000*	*.160*		*.000*
	N	*710*	*710*	*710*	*710*
Question 43	Pearson Correlation	*.335(**)*	*.012*	*.524(**)*	*1.000*
	Sig. (2-tailed)	*.000*	*.758*	*.000*	
	N	*710*	*710*	*710*	*710*
*** Correlation is significant at the 0.01 level (2-tailed).*					

Table 74. Initial Extraction of the Principal Components analysis for the Relationship Dimension.

Item	Initial	Extraction
Question	*1.000*	*.499*
Question1	*1.000*	*.560*
Question2	*1.000*	*.466*
Question3	*1.000*	*.612*
Question11	*1.000*	*.544*
Question12	*1.000*	*.601*
Question13	*1.000*	*.404*
Question14	*1.000*	*.486*
Question22	*1.000*	*.201*
Question23	*1.000*	*.649*
Question24	*1.000*	*.630*
Question25	*1.000*	*.622*
Question33	*1.000*	*.553*
Question34	*1.000*	*.579*
Question35	*1.000*	*.363*
Question36	*1.000*	*.367*
Extraction Method: Principal Component Analysis.		

Table 75. Total Variance (Relationship Dimension).

	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	*3.894*	*24.340*	*24.340*	*3.894*	*24.340*	*24.340*
2	*1.642*	*10.260*	*34.600*	*1.642*	*10.260*	*34.600*
3	*1.322*	*8.263*	*42.863*	*1.322*	*8.263*	*42.863*
4	*1.278*	*7.988*	*50.850*	*1.278*	*7.988*	*50.850*
5	*.973*	*6.081*	*56.931*			
6	*.824*	*5.151*	*62.082*			
7	*.799*	*4.995*	*67.077*			
8	*.752*	*4.702*	*71.779*			
9	*.717*	*4.481*	*76.260*			
10	*.670*	*4.187*	*80.447*			
11	*.619*	*3.871*	*84.318*			
12	*.574*	*3.589*	*87.907*			
13	*.539*	*3.371*	*91.278*			
14	*.499*	*3.121*	*94.399*			
15	*.479*	*2.993*	*97.392*			
16	*.417*	*2.608*	*100.000*			
Extraction Method: Principal Component Analysis.						

Table 76. Rotated Component Matrix (Relationship Dimension).

Items	**Component**			
	1	**2**	**3**	**4**
Item 1	*.267*	*.567*	*-.270*	*-.184*
Item 2	*.645*	*-.192*	*-.311*	*9.714E-02*
Item 3	*.596*	*-.292*	*.113*	*-.115*
Item 4	*.446*	*.280*	*.370*	*.445*
Item 12	*.442*	*.553*	*-.148*	*-.144*
Item 13	*.650*	*-.283*	*-.291*	*-.115*
Item 14	*.529*	*-.297*	*-2.473E-02*	*-.186*
Item 15	*.475*	*9.902E-02*	*.448*	*-.221*
Item 23	*.101*	*-.327*	*7.949E-02*	*.278*
Item 24	*.461*	*-4.142E-02*	*-.274*	*.600*
Item 25	*.426*	*.303*	*8.062E-02*	*.592*
Item 26	*.344*	*.140*	*.687*	*-.112*
Item 34	*.311*	*.592*	*-.244*	*-.214*
Item 35	*.692*	*-.218*	*-.173*	*-.152*
Item 36	*.590*	*-3.307E-02*	*4.988E-02*	*-.106*
Item 37	*.531*	*-.129*	*.206*	*-.161*
Extraction Method: Principal Component Analysis.				
a 4 components extracted.				

Table 77. Principal Components Analysis (Personal Growth Dimension).

Items	**Initial**	**Extraction**
Question 5	*1.000*	*.439*
Question 6	*1.000*	*.532*
Question 16	*1.000*	*.463*
Question 17	*1.000*	*.359*
Question 27	*1.000*	*.491*
Question 28	*1.000*	*.540*
Question 38	*1.000*	*.388*
Question 39	*1.000*	*.430*
Extraction Method: Principal Component Analysis.		

Table 78. Total Variance (Personal Growth Dimension).

Items	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Comp	**Total**	**% of Var**	**Cum %**	**Tot**	**% of Var**	**Cum %**	**Total**	**% of Va**	**Cum %**
1	*2.330*	*29.124*	*29.124*	*2.330*	*29.124*	*29.12*	*2.266*	*28.324*	*28.32*
2	*1.312*	*16.397*	*45.521*	*1.312*	*16.397*	*45.52*	*1.376*	*17.197*	*45.52*
3	*.987*	*12.342*	*57.863*						
4	*.780*	*9.746*	*67.608*						
5	*.766*	*9.579*	*77.188*						
6	*.683*	*8.543*	*85.731*						
7	*.593*	*7.414*	*93.145*						
8	*.548*	*6.855*	*100.000*						
Extraction Method: Principal Component Analysis.									

Table 79. Rotated Component Matrix (Personal Growth Dimension).

Item	Component	
	1	**2**
Item 5	*.644*	*-.155*
Item 6	*.677*	*.272*
Item 16	*.677*	*-6.210E-02*
Item 17	*.524*	*.290*
Item 27	*6.143E-02*	*-.698*
Item 28	*.156*	*.718*
Item 38	*.523*	*-.338*
Item 39	*.598*	*.269*
Rotation Method: Varimax with Kaiser Normalisation.		
a Rotation converged in 3 iterations.		

Table 80. Rotated Component Matrix (Personal Growth Dimension).

Item	**Component**	
	1	**2**
Item 5	*.644*	*-.155*
Item 6	*.677*	*.272*
Item 16	*.677*	*-6.210E-02*
Item 17	*.524*	*.290*
Item 27	*6.143E-02*	*-.698*
Item 28	*.156*	*.718*
Item 38	*.523*	*-.338*
Item 39	*.598*	*.269*
Rotation Method: Varimax with Kaiser Normalisation.		
a Rotation converged in 3 iterations.		

Table 81. Principal Components Analysis for the System Maintenance (SM) & Change Dimensions (CD) Dimension.

Items	**Initial**	**Extraction**
Question 7	*1.000*	*.457*
Question 8	*1.000*	*.417*
Question 9	*1.000*	*.484*
Question 10	*1.000*	*.484*
Question 11	*1.000*	*.584*
Question 18	*1.000*	*.439*
Question 19	*1.000*	*.229*
Question 20	*1.000*	*.592*
Question 21	*1.000*	*.409*
Question 22	*1.000*	*.543*
Question 29	*1.000*	*.426*
Question 30	*1.000*	*.539*
Question 31	*1.000*	*.517*
Question 32	*1.000*	*.671*
Question 33	*1.000*	*.666*
Question 40	*1.000*	*.263*
Question 41	*1.000*	*.410*
Question 42	*1.000*	*.481*
Question 43	*1.000*	*.653*
Question 44	*1.000*	*.687*
Extraction Method: Principal Component Analysis.		

Table 82. Total Variance (SM & CD Dimension).

Item	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Comp	**Tot**	**% Variance**	**Cumu %**	**Tot**	**% of Var**	**Cum %**	**Tot**	**% of Var**	**Cum %**
1	*3.10*	*15.498*	*15.498*	*3.10*	*15.5*	*15.50*	*2.01*	*10.03*	*10.030*
2	*1.99*	*9.956*	*25.454*	*1.99*	*9.96*	*25.45*	*1.93*	*9.631*	*19.661*
3	*1.44*	*7.196*	*32.650*	*1.44*	*7.20*	*32.65*	*1.91*	*9.537*	*29.198*
4	*1.32*	*6.621*	*39.271*	*1.32*	*6.62*	*39.27*	*1.69*	*8.470*	*37.668*
5	*1.07*	*5.368*	*44.639*	*1.07*	*5.37*	*44.63*	*1.37*	*6.847*	*44.515*
6	*1.02*	*5.117*	*49.755*	*1.02*	*5.12*	*49.76*	*1.05*	*5.240*	*49.755*
7	*.988*	*4.941*	*54.696*						
8	*.930*	*4.652*	*59.348*						
9	*.882*	*4.409*	*63.757*						
10	*.851*	*4.256*	*68.012*						
11	*.801*	*4.005*	*72.018*						
12	*.788*	*3.940*	*75.958*						
13	*.732*	*3.659*	*79.617*						
14	*.689*	*3.447*	*83.063*						
15	*.648*	*3.242*	*86.305*						
16	*.610*	*3.049*	*89.354*						
17	*.581*	*2.906*	*92.260*						
18	*.565*	*2.825*	*95.085*						
19	*.528*	*2.638*	*97.723*						
20	*.455*	*2.277*	*100.000*						
Extraction Method: Principal Component Analysis.									

Table 83. Rotated Component Matrix (SM & CD Dimension).

Item	Component					
	1	2	3	4	5	6
Item 7	*-3.729E-02*	*.639*	*9.371E-02*	*-.115*	*6.430E-02*	*-.145*
Item 8	*.227*	*.561*	*-.134*	*.129*	*8.351E-03*	*.126*
Item 9	*3.564E-02*	*7.180E-02*	*-.197*	*.662*	*-2.239E-03*	*1.304E-02*
Item 10	*.597*	*.279*	*2.980E-02*	*4.805E-03*	*-.107*	*.195*
Item 11	*-.168*	*.116*	*.253*	*-3.051E-02*	*8.644E-02*	*.685*
Item18	*.181*	*.633*	*-5.776E-02*	*-4.920E-02*	*-1.630E-02*	*-4.003E-03*
Item19	*.265*	*.168*	*-.128*	*.319*	*-9.375E-02*	*6.151E-02*
Item20	*8.991E-03*	*-.137*	*.171*	*.729*	*-2.788E-02*	*-.104*
Item21	*5.742E-02*	*-.195*	*.570*	*.190*	*-1.423E-02*	*8.123E-02*
Item22	*-.162*	*9.784E-02*	*.324*	*-6.634E-03*	*8.374E-02*	*-.629*
Item29	*5.589E-03*	*.135*	*.633*	*-2.726E-02*	*7.009E-02*	*-3.251E-02*
Item30	*.209*	*8.667E-02*	*-.644*	*.170*	*-.201*	*-5.132E-02*
Item31	*-.141*	*1.229E-03*	*-.661*	*.220*	*3.952E-02*	*.101*
Item32	*.811*	*2.847E-02*	*6.445E-02*	*4.748E-02*	*-1.361E-02*	*-7.325E-02*
Item33	*-.116*	*6.850E-02*	*2.299E-02*	*-2.804E-02*	*.795*	*-.124*
Item40	*5.136E-03*	*.477*	*4.713E-02*	*.178*	*3.392E-02*	*2.296E-02*
Item 41	*.263*	*.447*	*-.114*	*.323*	*1.643E-02*	*.153*
Item42	*.120*	*.373*	*-9.421E-02*	*.562*	*-4.189E-02*	*3.622E-02*
Item43	*.781*	*.119*	*-1.587E-02*	*.130*	*5.138E-02*	*-9.405E-02*
Item44	*6.953E-02*	*1.266E-02*	*.128*	*-4.785E-02*	*.803*	*.134*
Rotation Method: Varimax with Kaiser Normalisation.						
A Rotation converged in 7 iterations.						

Table 84. Descriptive Statistics for the 'Peer Cohesion' group.

Descriptive Statistics	Item 2	Item 3	Item 13	Item 14	Item 35	Item 36	Item 37
Valid	*710*	*710*	*710*	*710*	*710*	*710*	*710*
Missing	*10*	*10*	*10*	*10*	*10*	*10*	*10*
Median	*4.00*	*4.00*	*3.00*	*4.00*	*4.00*	*4.00*	*3.00*
Mode	*4.00*	*4.00*	*4.00*	*4.00*	*4.00*	*4.00*	*4.00*
Mean	*3.78*	*. 3.563*	*3.22*	*3.58*	*3.37*	*3.73*	*3.22*
Std. Deviation	*.939*	*.987*	*1.09*	*1.01*	*1.04*	*.84*	*.95*
Skewness	*-.870*	*-.694*	*-.32*	*-.76*	*-.45*	*-1.12*	*-.45*
Kurtosis	*.320*	*-.182*	*-.84*	*-.06*	*-.58*	*1.16*	*-.77*

Table 85. Descriptive statistics for the 'Involvement' group.

Descriptive Statistics	Item 1	Item 12	Item 34
Count Valid	*710*	*710*	*710*
Count Missing	*10*	*10*	*10*
Median	*4.000*	*4.000*	*4.000*
Mode	*4.000*	*4.000*	*4.000*
Std. Deviation	*.795*	*.760*	*.736*
Skewness	*-1.400*	*-1.134*	*-1.170*
Mean	*4.175*	*4.144*	*4.169*
Kurtosis	*3.074*	*2.185*	*2.713*

Table 86. Descriptive statistics for the 'Expressiveness' group.

Descriptive Statistics		Item 26
N	Valid	*710*
	Missing	*10*
Median		*4.00*
Mode		*4.00*
Std. Deviation		*1.093*
Mean		*3.580*
Skewness		*-.728*
Kurtosis		*-.346*

Table 87. Descriptive statistics for the 'Staff Support' group.

Descriptive Statistics		Item 24	Item 25
N	Valid	710	710
	Missing	10	10
Median		4.00	4.00
Mode		4.00	4.00
Std. Deviation		1.046	.957
Mean		3.558	3.906
Skewness		-.664	-1.088
Kurtosis		-.337	.897

Table 88. Descriptive statistics for the 'Workplace Autonomy' group.

Descriptive Statistics		Item 5	Item 6	Item 16	Item 17	Item 38	Item 39
N	Valid	710	708	710	710	710	710
	Missing	10	12	10	10	10	10
Median		4.00	4.00	4.00	4.00	3.00	4.00
Mode		4.00	4.00	4.00	4.00	4.00	4.00
Std. Deviation		1.112	.950	.970	.809	.844	.906
Skewness		-.294	-.847	-.689	-1.245	-.366	-.829
Mean		3.279	3.654	3.554	3.913	3.321	3.675
Kurtosis		-1.028	.129	-.338	2.360	-.285	.195

Table 89. Descriptive statistics for the 'Task Orientation' group.

Descriptive Statistics		Item 27	Item 28
N	Valid	710	710
	Missing	10	10
Median		2.00	4.00
Mode		2.00	4.00
Std. Deviation		.974	1.119
Skewness		.526	-.241
Mean		2.569	3.263
Kurtosis		-.512	-1.119

Table 90. Descriptive statistics for the 'Physical Environment' group.

Descriptive Statistics		Item 10	Item 32	Item 43
N	Valid	*710*	*710*	*710*
	Missing	*10*	*10*	*10*
Median		*3.00*	*2.00*	*3.00*
Mode		*4.00*	*2.00*	*4.00*
Std. Deviation		*1.115*	*1.118*	*1.054*
Skewness		*-.283*	*.622*	*-.172*
Mean		*3.118*	*2.373*	*3.010*
Kurtosis		*-.907*	*-.476*	*-.950*

Table 91. Descriptive statistics for the 'Clarity' group.

Descriptive Statistics		Item 7	Item 8	Item 18
N	Valid	*710*	*709*	*710*
	Missing	*10*	*11*	*10*
Median		*4.00*	*4.00*	*4.00*
Mode		*4.00*	*4.00*	*4.00*
Std. Deviation		*.896*	*.954*	*.886*
Skewness		*-.582*	*-.842*	*-.813*
Mean		*3.607*	*3.642*	*3.775*
Kurtosis		*-.310*	*.110*	*.391*

Table 92. Descriptive statistics for the 'Staff Supervision' group.

Descriptive Statistics		Item 21	Item 29	Item 30	Item 31
N	Valid	*710*	*710*	*710*	*710*
	Missing	*10*	*10*	*10*	*10*
Median		*3.00*	*3.50*	*3.00*	*4.00*
Mode		*2.00*	*4.00*	*2.00*	*4.00*
Std. Deviation		*1.019*	*1.061*	*1.215*	*1.145*
Skewness		*.310*	*-.293*	*.134*	*-.300*
Mean		*2.741*	*3.187*	*2.808*	*3.180*
Kurtosis		*-.699*	*-1.020*	*-1.202*	*-1.071*

Table 93. Descriptive statistics for the 'Innovation' group.

Descriptive Statistics		Item 9	Item 20	Item 42
N	Valid	*710*	*710*	*710*
	Missing	*10*	*10*	*10*
Median		*4.00*	*4.00*	*4.00*
Mode		*4.00*	*4.00*	*4.00*
Std. Deviation		*.994*	*.910*	*.993*
Skewness		*-.600*	*-.874*	*-.555*
Mean		*3.411*	*3.486*	*3.390*
Kurtosis		*-.555*	*-.163*	*-.527*

Table 94. Descriptive statistics for the 'Work Pressure' group.

Descriptive Statistics		Item 33	Item 44
N	Valid	*710*	*710*
	Missing	*10*	*10*
Median		*4.00*	*4.00*
Mode		*4.00*	*4.00*
Std. Deviation		*1.093*	*.955*
Skewness		*-.968*	*-.810*
Mean		*3.845*	*3.842*
Kurtosis		*.142*	*.120*

Table 95. Descriptive statistics for the 'Reward System' group.

Descriptive Statistics		Item 11	Item 22
N	Valid	*710*	*710*
	Missing	*10*	*10*
Median		*4.00*	*3.00*
Mode		*4.00*	*2.00*
Std. Deviation		*1.078*	*1.172*
Skewness		*-.444*	*.237*
Mean		*3.385*	*2.894*
Kurtosis		*-.770*	*-1.094*

Table 96. Summary of categories occurring in each analysis.

Dimension	**Category occurring in the Principal Components Analysis**	**Category occurring in the Regression analysis**
Relationship	*'involvement', 'peer cohesion', 'supervisor support', 'expressiveness'*	*'involvement', 'peer cohesion', 'supervisor support'*
Personal Growth	*'task orientation', 'autonomy'*	*'task orientation'*
Systems maintenance & change	*'clarity', 'innovation', 'physical environment', 'staff supervision', 'reward system'*	*nil*

Appendix 10

Minimal Risk Form

Tasmania
DEPARTMENT *of* HEALTH *and* HUMAN SERVICES

Human Research

Ethics Committee (Tasmania) Network

UNIVERSITY OF TASMANIA

MINIMAL RISK ASSESSMENT FORM – SOCIAL SCIENCE APPLICATIONS

Refer: 'Expedited Review for Minimal Risk Research' 2.27 Pg 19 *National Statement on Ethical Conduct in Research Involving Humans – June 1999*

Ethics applications that are truly minimal risk may be subject to a briefer and simpler ethics approval process than other ethics applications. The two main advantages of a minimal risk application are the following:

(1) there is no need to complete a full ethics application form. Instead, this Minimal Risk Form must be accompanied by:

- Information Sheets for each cohort (including Focus Groups)
- Consent Forms for each cohort (including Focus Groups) (although this may not be needed if the research involves a questionnaire that is entirely anonymous).
- Questionnaires (if relevant)
- Interview Schedules (if relevant)

(2) the material that is required is submitted to the Chair of either the Northern or Southern Tasmania Social Science Human Research Committee for review. However, the Chair to which the application is

allocated reserves the right to make a judgement on whether the application is truly minimal risk, and may ask researchers to submit a full ethics application to the Committee if he or she considers the application involves more than everyday risk.

ELIGIBILITY:

Completion of the following checklist will assist in ascertaining whether your research project can be considered ‘minimal risk’. Student researchers must review the completed checklist and their application form with their supervisors.

An application that answers ‘No’ to each of the questions is likely to be treated as a ‘minimum risk application’.

If you have answered ‘Yes’ to **any question that requires you to give an explanation**, you may nonetheless submit a minimal risk application. The Chair of the relevant Committee will then determine whether any further information, or a full ethics application, is necessary.

If you answered ‘Yes’ to any other item in the checklist, but you still believe that because of the particular nature of the project or the participants your project may still be eligible for minimal risk review, please contact the Chair or the Executive Officer of the Human Research Ethics Committee, who will advise.

However, if your research is being funded by the ARC or the NH&MRC, the minimal risk application process is not available to you, and you must submit a full ethics application.

Completed minimal risk applications must be sent to:

Ethics Support Officer

Research & Development Office

University of Tasmania

Private Bag 1

Hobart Tasmania 7001

Title of Research	Maritime Culture: A description and some possible effects it has on accidents and lessons for seafaring leadership.
Chief Investigator Name:	John Williamson
Phone:	Email: John.Williamson@utas.edu.au
Signature	
Department/Centre:	
Other Investigator Name:	Ian P Shea
Phone:	Email:I.Shea@mte.amc.edu.au
Signature	
Other Investigator Name:	
Phone:	Email:
Signature	
Other Investigator Name:	
Phone:	Email:
Signature	

10.1.1.1.1 Status	10.1.1.1.2 ☐ Academic	
	☑ Student	☐ Honours ☐ Masters ☐ GRAD DIP ☑ PHD

By signing the above, all investigators are confirming the following statements:

1. I confirm that I have read and abide by the principles as explained in the *National Statement on Ethical Conduct Involving Humans* (NH&MRC)

Indicate the School at which the data will be retained.	Faculty of MT&E at the Australian Maritime College

Statement of scientific merit

The **Head of School*** is required to sign the following statement:

This proposal has been considered and is sound with regard to **its merit and methodology**.

The Head of School's (or Head of Discipline's) signature on the application form indicates that he/she has read the application and confirms that it is sound with regard to (i) educational and/or scientific merit and (ii) research design and methodology. If the Head of School/Discipline is one of the investigators this statement must be signed by an appropriate person. This will normally be the Head of School/Discipline in a related area.

This does not preclude the Committee from questioning the research merit or methodology of any proposed project where if feels it has the expertise to do so.

(Name of Head of School) (Signature) (Date)

* Where the Head of School is an investigator, In some schools the signature of the Head of Discipline may be more appropriate.

* An investigator on the project may not give the certification of scientific merit.

2. That all the following responses are true and accurate.

3. I confirm that all data (video and audio tapes, questionnaires etc) will be kept securely stored during the research, and retained under lock and key in the School to which I belong for a period of 5 years after completion of the research. Your School/Institution will have policies in relation to the retention of data.

4. I undertake to use the data and information collected in the research only for the purposes of the research, to make no unauthorised disclosure of that data or information, and to maintain

the anonymity of all participant data except pursuant to the express consent of the relevant participant(s).

SECTION 1 - EXTERNAL REQUIREMENTS

Is the research being funded by an agency outside the University, which requires Human Research Ethics Committee approval?	☐ YES	☑ NO
Provide funding/grant details:		

NB: If you are being funded by the ARC or the NH&MRC, then you must fill out the standard ethics application form

SECTION 2 - RISK ASSESSMENT

A. Are any of the following topics to be covered in part or in whole?

Research about/involving/investigating:	YES	NO
Parenting practices	☐ YES	☑ NO
Sensitive personal issues	☐ YES	☑ NO
Sensitive cultural issues	☐ YES	☑ NO
Grief, death or serious/traumatic loss	☐ YES	☑ NO
Depression, mood states, anxiety	☐ YES	☑ NO
Gambling	☐ YES	☑ NO
Eating disorders	☐ YES	☑ NO
Illicit drug taking	☐ YES	☑ NO

Substance abuse	☐ YES	☑ NO
Self report of criminal behaviour	☐ YES	☑ NO
Any psychological disorder	☐ YES	☑ NO
Suicide	☐ YES	☑ NO
Gender identity	☐ YES	☑ NO
Sexuality	☐ YES	☑ NO
Race or ethnic identity	☐ YES	☑ NO
Any disease or health problem	☐ YES	☑ NO
Fertility	☐ YES	☑ NO
Termination of pregnancy	☐ YES	☑ NO

B. Are any of the following procedures to be employed?

Use of personal data obtained from Commonwealth or State Government Department/Agency **without the consent** of the participants e.g. getting a list of addresses from the Australian Electoral Commission	☐ YES	☑ NO
If you have answered yes, please state which Commonwealth Agency is involved and what information is being sought:		
Deception of participants	☐ YES	☐ NO
Concealing the purposes of the research	☐ YES	☐ NO
Covert observation	☐ YES	☐ NO

Audio or visual recording **without consent**	☐ YES	☐ NO
Recruitment via a third party or agency	☐ YES	☐ NO
NB: If you have answered Yes, under no circumstances must researchers receive a list of addresses from third parties or agencies, as this would contravene the Privacy Act 1988 (Cth). Researchers may have their Information Sheet and Consent Forms sent to possible participants through the third parties and agencies. This will allow possible participants to volunteer without any coercion. **Please indicate what your method of recruitment is going to be:** **An Information Sheet needs to be sent to the head of agencies/businesses/associations/clubs etc introducing the research and politely enlisting their help in distributing the Information Sheet and Consent Forms to the intended cohort.**		
Withholding from one group specific treatments or methods of learning, from which they may "benefit" (e.g., in medicine or teaching)	☐ YES	☑ NO
Any psychological interventions or treatments	☐ YES	☑ NO
Administration of physical stimulation	☐ YES	☑ NO
Invasive physical procedures	☐ YES	☑ NO
Infliction of pain	☐ YES	☑ NO
Administration of drugs	☐ YES	☑ NO
Administration of other substances	☐ YES	☑ NO
Administration of ionising radiation	☐ YES	☑ NO
Tissue sampling or blood taking	☐ YES	☑ NO

Collecting body fluid	☐ YES	☑ NO
Genetic testing	☐ YES	☑ NO
Use of medical records where participants can be identified or linked	☐ YES	☑ NO
Drug trials and other clinical trials	☐ YES	☑ NO
Administration of drugs or placebos	☐ YES	☑ NO

C. Other Risks

Are there any risks to the researcher, (e.g. research undertaken in unsafe environments or trouble spots)?	☐ YES	☑ NO

SECTION 3 - PARTICIPANTS - VULNERABILITY ASSESSMENT

Do any of the participants fall within the following targeted categories?

Suffering a psychological disorder	☐ YES	☑ NO
Suffering a physical vulnerability	☐ YES	☑ NO
People highly dependent on medical care	☐ YES	☑ NO
Minors without parental or guardian consent where they are the focus of the research	☐ YES	☑ NO
People whose ability to give consent is impaired	☐ YES	☑ NO
Resident of a custodial institution	☐ YES	☑ NO
Unable to give free informed consent because of difficulties in understanding information statement (eg language difficulties)	☐ YES	☑ NO

Members of a socially identifiable group with special cultural or religious needs or political vulnerabilities	☐ YES	☑ NO
Those in dependent relationship with the researchers (eg lecturer/student, doctor/patient, teacher/pupil, professional/client)	☐ YES	☑ NO
Participants be able to be identified in any final report when specific consent for this has not been given	☐ YES	☑ NO
Indigenous Australians where Indigenous Australians are the focus of the research	☐ YES	☑ NO

10.1.1.2 SECTION 4 - RESEARCH IN OVERSEAS SETTINGS

Does the research involve any of the following?

1. **It is important for Chief Investigators to ensure that they or the other researchers involved in the research have adequately addressed any research requirements of the countries in which their research is being undertaken.**

2. **A native speaking interpreter must verify information Sheets provided in another language.**

Research being undertaken in a politically unstable area	☐ YES	☑ NO
Research involving sensitive cultural issues	☐ YES	☑ NO
Research in countries where criticism of government and institutions might put participants and/or researchers at risk	☐ YES	☑ NO

SECTION 5 – RESEARCH INVOLVING COMMERCIAL-IN-CONFIDENCE INFORMATION OR SENSITIVE POLITICAL/COMMERCIAL ISSUES

Does your research explore potentially confidential business practices or seek to elicit potentially confidential commercial information from participants?	☐ YES	☑ NO
If you have answered 'YES' to this question, please describe how you will protect the confidentiality of each participant's information:		
Does your research explore potentially divergent political views, or involve the collection of politically sensitive information?	☐ YES	☑ NO
If you have answered 'YES' to this question, please describe how you will protect the confidentiality of each participant's information:		

Appendix 11

Supporting document for the Minimal Risk Form.

Maritime Culture: A description and some possible effects it has on accidents and lessons for seafaring leadership.

Study Aims

This study has one major and several minor aims. The major aim of this thesis is to describe maritime culture and climate, as reported by seafarers regardless of their nationality or organisational affiliation, within the context of safe ship operations. The study aims to develop a framework of understanding the linkages that may occur between maritime culture, climate and marine accidents. To achieve the above, the first minor aim is to understand what culture and climate existed on ships. The second minor aim is to understand the normal working practices of seafarers aboard ship. The third minor aim is to examine how marine accidents occur, what some of the most common form of accidents are, and the frequency of occurrence of marine accidents.

The study will analyse the responses of seafarers to determine whether any linkages between the above three issues exists, namely culture, climate and marine accidents. With the major and minor aims in mind, the following research questions guide the study.

11.1.1 Research Questions

The overall question this thesis aims to address is: 'in what way does maritime culture and climate influence marine accidents?' The following research questions have been framed to address this.

11.1.1.1 Research Question 1: How does a ship's crew perceive its organisational culture?

To address this research question the following sub-questions have been developed:

- What observable behaviours do seafarers display when working aboard ship?
- What do seafarers value about their working environment?
- What assumptions guide the actions of seafarers?

11.1.1.2 Research Question 2: Does a common organisational culture exist on all ships?

To address this research question the following sub-questions have been developed:

- Is the culture the same on all ships regardless of nationality?
- Does a person's view of maritime culture depend on the department to which that person belongs?

11.1.1.3 Research Question 3: What relationship exists between human error and maritime accidents?

To address this research question the following sub-questions have been developed:

- Does the size of ship have any impact on the rate of occurrence of accidents?
- Does the number of people employed aboard have any impact on the rate of occurrence of accidents?

- Does the time spent aboard a vessel have any impact on the rate of occurrence of accidents?
- Does a person's view of how they carry out a job have an impact on the rate of occurrence of accidents?

11.1.1.4 Research Question 4: How does a ship's crew perceive its organisational climate?

11.1.2 The Research Methodology

This study will use a research approach that combines elements of quantitative as well as qualitative methods. This mixed-mode is deemed the way to proceed as the researcher wishes to utilise data gathering approaches that have been used in both broad research approaches, i.e., a questionnaire, metaphorical analysis, and document analysis. The mixed-mode approach has been advocated by authors such as Burns (2000), Robson (2002), as it allows investigation of questions and issues where there is a bounded system (Burns, 2000) but the participants are dispersed and not readily accessible for extended, face-to-face data gathering.

An initial foray into the workplace, for the purpose of identifying issues, consisted of ten unstructured interviews with seafarers. These interviews, and study of associated literature, provided the initial evidence that a linkage between culture and accidents may exist. The close almost inextricable link between culture and climate also became apparent as the literature review progressed.

11.1.2.1 Data Collection Instruments

The number of instruments necessary to address adequately the issues raised is also a matter that requires some consideration.

The different stages of cultural development require a different approach to obtain the desired information. As an example, the best way to determine the unconscious assumptions of seafarers requires the use of metaphorical imagery (Krefting & Frost, 1985). For determining the Observable Behaviour and Values of seafarers a direct questioning approach can be used. The instrument required to determine the assumptions therefore will be different from the direct questioning approach necessary for the Observable Behaviour and Values. Thus two instruments are necessary to describe Maritime Culture.

As maritime climate tests different issues from that of culture, another instrument that tests these issues is necessary. An existing validated instrument is used, as it has been designed for testing the climate in various work settings (Moos, 1974). In all therefore, it is proposed to administer three instruments to obtain the required data for this study.

11.1.2.2 Sample

All seafarers that work aboard a ship are identified by the study as the sample population. As the results are to be generalisable across the whole seafaring population of the maritime industry, the selected sample population would have to represent the views of seafarers from all flag states (Gay, 1992). Thus the larger the size of the sample population and the more flag state ships involved would enable a more generalisable picture to emerge (Gay, 1992).

The very nature of seafaring disperses seafarers very widely across the globe on board many ships. Thus as individuals they are clearly not easily accessible. When seafarers are home on leave they disperse even more widely. It was necessary to identify areas or means of getting into contact with them more efficiently. Two avenues were identified;

the first was the Nautical Training Institutes where seafarers congregated for training purposes. The second method was to contact them through their professional organisations, like the Nautical Institute. The method that best suited this method of sampling was the cluster sampling method (Gay, 1992). The target population therefore are all those seafarers who are studying at various maritime educational institutes and those seafarers who are members of their respective professional organisations. To obtain strong generalisable results, it was decided to use the maritime institutes located in as many different countries as possible.

Thus persons who were doing their certificate of competency examination at the training institute fulfilled the criteria of being seafarers who had seagoing experience. In addition, the training institutes of the UK and Australia had seafarers from many other countries studying there and many of these students had worked on 'flag of convenience' vessels. The students studying at these training institutes were thus available as the main target population and would have been familiar with the completion of various data gathering instruments as part of their regular activities.

The main method of distribution therefore was to approach the administrations of various nautical institutes, apprise them of the study and request their cooperation. Once an institution agreed to participate in the study, a date was set for the application to take place.

A second avenue to contact active seafarers was to use the Nautical Institute as a platform for distribution of the instruments it to its members. The Nautical Institute has 38 branches around the world and has between 7000 and 8000 members. Its membership consists of people working in the maritime industry. In addition the membership is restricted to maritime professionals therefore effectively ruling out ratings. The Institute often acts as the distributor of data gathering instruments for individual researchers or teams. The Nautical Institute sends the instruments in their magazine 'Seaways' to every member. A return address is provided; it is not possible to provide a stamped envelope, as the members of the institute come from many countries.

Appendix 12

Maritime Culture Questionnaire (German version)

Maritime Culture Questionnaire

In diesem Fragebogen geht es um das Schiff auf dem Sie zuletzt beschaeftigt waren und das Arbeitsklima auf diesem. Nach einigen Angaben zum Schiff selbst, finden sich auf den naechsten Seiten Aussagen die durch einfaches Ankreuzen des jeweiligen Feldes mit

N - stimmt ueberhaupt nicht

E - stimmt eher nicht

U - unentschieden

T - stimmt teilweise

S - stimmt genau

zu bewerten sind.

Vielen Dank fuer das Ausfuellen, saemtliche Angaben werden selbstverstaendlich vertraulich behandelt.

Angaben zum Schiff:

Nationalitaet des letzten Schiffes: ___________________

Wo haben Sie dort gearbeitet Deckoffizier / Offizier im Maschinenraum / Seemann

Groesse des Schiffes (in Tonnen deadweight):__(auf 1000t gerundet)

Wieviele Personen haben an Bord gearbeitet: ___________________

Wielange waren Sie jeweils an Bord: ___________________

Wie lange sind Besatzungsmitglieder normalerweise an Bord:

____

Fanden Sie Ihren Job interessant / komplex / eintoenig / einfach (mehrere

Antworten sind moeglich)

Gab es irgendwelche Unfaelle waehrend Sie an Bord waren? Ja/ Nein

Wenn ja welcher Art? Kollision / auf Grund laufen / Stranden / Feuer /

Kontakt (z.B. mit Seezeichen) / Personenschaden / andere,

naemlich ____________________

Maritime Culture Questionnaire

Offensichtliche Verhaltensweisen					
1. Alles an Bord war gut organisiert und die Vorgesetzten kontrollierten alles genau, um der Mannschaft zu elfen gute Arbeit zu leisten und die Crewmoral zu erbessern.	N	E	U	T	S
2. Vorschlaege zum Arbeitsablauf wurden in der bteilung regelmaessig diskutiert doch nur umgesetzt, wenn sie mit den Vorstellungen der Vorgesetzten uebereinstimmten.	N	E	U	T	S
3. Die Vorgesetzten setzten sich regelmaessig mit allen Crewmitgliedern zusammen, um Probleme zu diskutieren und gute Mitarbeiter zu loben.	N	E	U	T	S
4. Leute lernten ihre Arbeit indem sie die Vorgesetzten nachahmten. Durch Mimik und Gestik wurde einem ausserdem klar.' dass Kritik oder Diskussionen nicht erwuenscht sind.	N	E	U	T	S
5. Die Vorgesetzten zeigten den normalerweise ueblichen Arbeitsablauf, indem sie diesen vorbildlich einhielten, sie ermutigten aber auch zur Diskussion und Kritik fuer Verbesserungen.	N	E	U	T	S
6. Zustaendigkeiten waren stark struckturiert und explizit verteilt. Abweichungen von diesen Vorgaben wurden geruegt oder bestraft.	N	E	U	T	S

Werte					
1 Crew und Offiziere glaubten, dass Regeln und Vorschriften auf dem Schiff, dem Vorteil des Schiffer und des Lebens on bord dienten.	N	E	U	T	S
2. Die meisten Crewmitglieder hielten nichts oder wenig von Arbeitsbeispielen von Vorgesetzten, da diese anschliessend, selbst bei gleichem Arbeitsablauf, doch nur kritisieren underniedrigen.	N	E	U	T	S
3. Die Crewmitglieder achteten ihre Vorgesetzten dafuer, dass ihre Meinung gefragt war, um effizientere Arbeitsmethoden zu finden.	N	E	U	T	S
4. Die meisten Crewmitglieder glaubten, dass die endlosen Diskussionen unnuetz sind, da die Schiffsfuehrung doch nur Loesungen akzeptiert die sie selbst erdacht haben.	N	E	U	T	S
5. Die Crewmitglieder achteten ihre Vorgesetzten sehr, denn diese beschrieben nicht nur den Job selbst, sondern auch das Ergebnis sehr genau.	N	E	U	T	S
6. Die Crewmitglieder glaubten nicht an die Regeln die von den Vorgesetzten aufgestellt wurden, da diese sich nie die Muehe machten deren Einhaltung zu kontrollieren.	N	E	U	T	S

Appendix 13

Assumptions through Metaphors (AtM)

Questionnaire (German version).

Assumptions through Metaphors (AtM) Questionnaire.

Bilder und Vergleiche

Erfahrene Seefahrer entwickeln Bilder, mit denen sie Schiffe, das Leben an Bord und andere Seeleute im allgemeinen vergleichen. Bitte geben Sie Ihre Einschaetzung zwischen stimmt nicht (N) und stimmt genau (S) zu den folgenden Behauptungen an.

Anschliessend kreuzen Sie bitte ausserdem an, welche der gegebenen Definitionen (a oder b) Ihrer Vorstellung entspricht. Falls keine der Definitionen so recht passt, oder Sie zwischen diesen unentschlossen sind, geben Sie unter c) einfach eine eigene Definition an. Bitte kreuzen Sie nicht beide Moeglichkeiten an.

1. Schiffe und das Leben an Bord gleichen einer \`Militaerkaserne'.

N	E	U	T	S

Eine Militaerkaserne ist

a) ein abgesicherter Ort, in dem hochqualifiziertes Personal darauf vorbereitet wird Anordnungen ohne hinterfragen nachzukommen.

b) eine Gefaengnisartige Institution in der Leute dazu gebracht werden Dinge zu tun, die sie nicht tun mochten.

c) ____

2. Schiffe und das Leben an Bord sind wie \`Fliessbaender'.

N	E	U	T	S

Ein Fliessband ist

a) eine gut geplantes System, das es erlaubt genau definiete Arbeiten fehlerlos auszufuehren.

b) Wo Menschen wie Roboter nach den Regeln ds Arbeitsplatzes arbeiten.

c) ____

3. Schiffe und das Leben an Bord gleichen einem `Orchester'.

N	E	U	T	S

Ein Orchester ist

a) eine Ansammlung von Musikern, die von einem Dirigenten dirigiert, Musik eines Komponisten reproduziert:.

b) eine Ansammlung von engagierten Leuten in einer bruppe, die zusammen an einem harmonischen Ergebnis arbeiten.

c) ____

4. Schiffe und das Leben an Bord gleichen einer `Herde'.

N	E	U	T	S

Eine Herde ist

a) eine Gruppe von Lebewesen, die blind ihrem Leithammel folgt.

b) eine Gruppe von Lebewesen, die in einer auf Gegenseitigkeit beruhenden Gemeinschaft leben, die durch gleiche Wertmassstaebe bestimmt wird.

c) ____

5. Schiffe und das Leben an Bord sind `Teams'.

N	E	U	T	S

Ein Team ist ,

a) eine Gruppe von Leuten, die aktiv Ideen und Strategien teilt, um gemeinsam ein bestimmets Ziel zu erreichen.

b) eine Gruppe von Menschen die von einer Person gefuehrt wird, um in eine bestimmte Richtung einzuschlagen oder einen bestimmten Job auszufuehren.

c) ____

6. Schiffe und das Leben an Bord sind `Bienenstoecke'.

N	E	U	T	S

Ein Bienenstoecke ist

a) ein Ort, an dem sich Mitglieder aktiv fuer ein gemeinsames Gut bemuehen.

b) ein Ort, wo Unmengen sinnloser Arbeiten verrichtet werden, um geringen sichtbaren Erfolg vorzuweisen.

c) ____

7. Schiffe und das Leben an Bord sind `Gettos'.

N	E	U	T	S

Ein Getto ist,

a) ein Gebiet in dem Einwohner meinen, sie haben einen Vorteil, dadurch dass sie mit Gleichgesinnten zusammen leben, die sich gegenseitig unterstuetzen.

b) ein Gebiet in der eine Minderheit von Menschen zusammengehalten wird, um sicherzustellen, dass sie sich nicht mit der restlichen Gesellschaft vermischt.

c) ____

8. Schiffe und das Leben an Bord sind ein `Forum'.

N	E	U	T	S

Ein Forum ist,

a) eine Plattform, die es Leuten ermoeglicht ihrem Aerger und Unmut Luft zu machen.

b) ein Ort, an dem viele ergebnisreiche Diskussionen stattfinden.

c) ____

9. Vorgesetzte und Schiffsfuehrung an Bord gleichen \`Expeditionsfuehrern'.

N	E	U	T	S

Ein \`Expeditionsfuehrer'

a) bestimmt welchen Pfad andere zu gehen haben.

b) hilft anderen einer gemeinsamen Mission nachzugehen.

c) ____

10. Vorgesetzte und Schiffsfuehrung an Bord sind \`am Ruder'.

N	E	U	T	S

\`Am Ruder' sind Leute, die

a) von semanderen Beferle empfangen um ein Ziel zu erreichen.

b) die Situation ueberblicken und mit gutem Beispiel vorrangehen.

c) ____

11. Vorgesetzte und Schiffsfuehrung an Bord sind `Rattenfaenger'.

N	E	U	T	S

Ein `Rattenfaenger' ist

a) eine qualifizierte Person die eine Gruppe von weniger Erfahrenen leitet.

b) eine unauffaellige Person, die Leichtglaeubige verfuehrt.

c) ____

12. Vorgesetzte und Schiffsfuehrung an Bord sind `Aerobic-Trainer'.

N	E	U	T	S

Ein `Aerobic-Trainer' ist jemand, der

a) ziemlich exhibistionistisch seine ueberlegenen Faehijbeiten darstellt.

b) durch Demonstration eine Gruppe von Leuten anleitet.

c) ____

Appendix 14

Maritime Climate (MClQ) Questionnaire

(German version).

Maritime Climate Questionnaire.

Bordklima und Arbeitsbedingungen

1. Es machte mich stoltz, dass ich mir soviel Muehe gab einen gute Arbeit zu leisten.	N	E	U	T	S
2. Meine Vorgesetzten unterstuetzten undermutigten mich.	N	E	U	T	S
3. Die Besatzungsmitglieder auf dem Schiff bildeten ein enges Team, indem man viel Unterstuetzun fand.	N	E	U	T	S
4. Ich hatte Angst den Vorgesetzten gegenueber meine Meinun zu sagen.	N	E	U	T	S
5. Ich hatte voellige Freiheit in der Ausfuehrung meiner Arbeit.	N	E	U	T	S
6. Unsere Vorgesetzten ermutigten uns effiziente Arbeitsmethoden zu entwickeln und weiterzugeben.	N	E	U	T	S
7. Regeln bestimmten einen grossen Teil des Lebens an Bord, da die Vorgesetzten diese als eine Form der Beaufsichtigung sahen.	N	E	U	T	S
8. Ich wusste immer genau was ich zu tun hatte, da mir die Vorgesetzten den Arbeitsablauf gut erklaert haben.	N	E	U	T	S
9. Ich konnte Arbeitsablaeufe aendern, wenn ich dies fuer vernuenfti hielt.	N	E	U	T	S
10. Die Strucktur und die Ausruestung an Bord waren der Grund dafuer, dass mir meine Arbeit soviel Spass machte.	N	E	U	T	S

11. Die Auswirkungen von schlechter Arbeit hatte ich waehrend meiner Arbeit auf dem Schiff immer im Hinterkopf.	N	E	U	T	S
12. Ich setzte mir fuer meine Arbeit an Bord hohe Massstaebe.	N	E	U	T	S
13. Die Schiffsfuehrung lobte gute Arbeit bei jeder Gelegenheit.	N	E	U	T	S
14. Mein Kollegen bemuehten sich immer mir zu helfen, wenn noeti .	N	E	U	T	S
15. Ich habe meinen Kollegen meine Meinung offen mitgeteilt.	N	E	U	T	S
16. Meine Vorgesetzten erlaubten mir alle Entscheidungen, die zur Ausfuehrung meines Jobs noeti waren, selbst zu treffen.	N	E	U	T	S
17. Eine Arbeit an Bord galt als gut, wenn sie effizient geplant und aus efuehrt wurde.	N	E	U	T	S
18. Regeln und Vorschriften waren zu unserem Besten und unsere Vorgesetzten verwiesen auf diese waehrend sie unsere Arbeit kontrollierten.	N	E	U	T	S
19. Die meisten Routine-Arbeiten an Bord bereiteten mir keinen Stress, da ich genau wusste was ich zu tun hatte.	N	E	U	T	S
20. Ich durfte einige Arbeitsablaeufe modifizieren ober nicht andre.	N	E	U	T	S

21. Da die Einrichtung effizientes Arbeiten nicht unterstuetzte, habe ich lieber draussen gearbeitet.	N	E	U	T	S
22. Das Hauptthema von Diskussionen waehrend der Freizeit war die Arbeit.	N	E	U	T	S
23. Ich hatte gute und schlechte Tage, aber die meisten meiner Vorgesetzten bescheinigten mir gute Arbeit zu leisten.	N	E	U	T	S
24. Egal was ich an Bord tat, ich wurde nie gelobt oder ermutigt.	N	E	U	T	S
25. Wenn ich einen Fehler machte, habe ich es meinen Kollegen lieber nicht erzaehlt, da sie es sicherlich dem Vorgesetzten berichtet haetten.	N	E	U	T	S
26. Ich hatte keine Angst irgendwem an Bord e enuebeber meine Meinun zu sagen.	N	E	U	T	S
27. Arbeiten mussten exakt nach dem vorgegebenen Muster aus efuehrt werden.	N	E	U	T	S
28. Keiner kontrolliert ob eine Arbeit gut ist oder nicht, meine Vorgesetzten erwarteten einfach, dass ich meiner Arbeit ohne grossen Aufhebens nachkomme.	N	E	U	T	S
29. An Bord gab es einfach Regeln fuer alles und falls meine Vorgesetzten meinten es ist noetig, erfanden sie neue.	N	E	U	T	S

30. Arbeiten an Bord war manchmal recht frustrierend, da einem keiner sagte wie bestimmte Jobs auszufuehren waren, wenn man es allerdings falsch machte, hatte jeder etwas zu meckern.	N	E	U	T	S
31. Es gibt an Bord nur einen Weg einer Arbeit nachzukommen und der lautet: so wie es immer emacht wurde.	N	E	U	T	S
32. Meine Unterbringung glich der eines 5-sterne Hotels. Es ist sehr angenehm in einer solchen Umgebung zu arbeiten.	N	E	U	T	S
33. Es wurde erwartet, dass man 24 Stunden am Tag auf Abruf zur Verfuegung steht, selbst wenn man den anzen Tag gearbeitet hatte.	N	E	U	T	S
34. Nach meinen eigenen hohen Massstaeben zu arbeiten befriedigte mich.	N	E	U	T	S
35. Meine Vorgesetzten schufen eine Atmosphaere, die mich ansporNte immer mein Bestes zu eben.	N	E	U	T	S
36. Die Unterstuetzung meiner Kollegen half mir bei Problemen, die ich alleinen nicht oder schlecht haette loesen koennen.	N	E	U	T	S
37. An Bord konnte man seine Meinung frei sagen, ohne missverstanden oder benachteili zu werden.	N	E	U	T	S

38. Meine Vorgesetzten betrachteten es als wichtig fuer einen reibungslosen Ablauf, dass jeder seiner Arbeit sebstaendig und selbstbestimmt nachkommt.	N	E	U	T	S
39. Vorrausplanen von Arbeiten war dank der Vorgesetzten ein fester Bestandteil des Arbeitens an Bord.	N	E	U	T	S
40. Es gibt in unserer Gesellschaft zu viele Regeln, diesemwurden von den Vorgesetzten an Bord jedoch so interpretiert, dass sie einen reibungslosen Ablauf ermoe lichen.	N	E	U	T	S
41. Die meisten Tage vergingen ohne groessere Aufregungen, da jeder genan wuste, was und er zeine Arbeit zu vevrichten hatte.	N	E	U	T	S
42. Versuche und innovative Ideen den Arbeitsablauf effizienter zu gestalten, wurden von den Vorgesetzten gern gesehen.	N	E	U	T	S
43. Die Einrichtung an Bord lud einem zum effizienten Arbeiten foermlich ein.	N	E	U	T	S
44. Es wurde von uns erwartet zu jeder Tages- (und Nacht-)zeit mit maximaler Effizient zu arbeiten.	N	E	U	T	S

Appendix 15

Analysis of the MCQ Instrument.

Table 97. Correlations for individual items in the Observable Behaviour section (Original Grouping).

Observable Behaviour	OB1	OB2	OB3	OB4	OB5	OB6
Pearson correlation Sig (2) tailed	*1.000* *...*	*.039* *.306*	*.449*** *.000*	*0.24* *.516*	*.363*** *.000*	*-.046* *.220*
Pearson correlation Sig (2) tailed	*.039* *.306*	*1.000* *...*	*.001* *.976*	*.163*** *.000*	*.051* *.172*	*.111*** *.003*
Pearson correlation Sig (2) tailed	*.449*** *.000*	*.001* *.976*	*1.000* *...*	*-.082** *.029*	*.393*** *.000*	*-.085** *.023*
Pearson correlation Sig (2) tailed	*.024* *.516*	*.163*** *.000*	*-.082** *.029*	*1.000* *...*	*-.004* *.909*	*.218*** *.000*
Pearson correlation Sig (2) tailed	*.363*** *.000*	*.051* *.172*	*.393*** *.000*	*-.004* *.909*	*1.000* *...*	*-.097*** *.010*
Pearson correlation Sig (2) tailed	*-.046* *.220*	*.111*** *.003*	*-.085** *.023*	*.218*** *.000*	*.097*** *.010*	*1.000* *...*
*** Correlation is significant at the 0.01 level (2-tailed)*						
** Correlation is significant qt the 0.05 level (2-tailed)*						

Table 98. Combined correlations of the items in the original grouping (Observable Behaviour Section).

Items	Correlations (r)	Probability (p)
1 & 6 (Formalistic Type)	*-0.05*	*0.22*
3 & 4 (Collegial Type)	*0.05*	*0.31*
2 & 5 (Personalistic Type)	*0.05*	*0.22*

Table 99. Combined correlations of the items in the original grouping (Values Section).

Items	Correlations (r)	Probability (p)
1 & 6 (Formalistic Type)	*0.13*	*0.003*
3 & 4 (Collegial Type)	*0.30*	*<0.0001*
2 & 5 (Personalistic Type)	*0.28*	*<0.0001*

Table 100. Internal consistency reliability of the combined items in the 'Values' Section.

Items	Internal Consistency Reliability (Cronbach α)
1 & 6 (Formalistic Type)	*0.20*
3 & 4 (Collegial Type)	*0.40*
2 & 5 (Personalistic Type)	*0.40*

Table 101. Principal components analyses for Observable Behavior Section.

Component	Initial	Extraction
OB1	*1.000*	*.610*
OB2	*1.000*	*.370*
OB3	*1.000*	*.635*
OB4	*1.000*	*.539*
OB5	*1.000*	*.556*
OB6	*1.000*	*.450*
Extraction Method: Principal Component Analysis.		

Table 102. Total Variance (Observable Behaviour Section).

Item	Extraction sums of squared loading			Rotation Sums of Squared Loading		
Component	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	*1.832*	*30.534*	*30.534*	*1.822*	*30.369*	*30.369*
2	*1.329*	*22.145*	*52.679*	*1.339*	*22.310*	*52.679*

Table 103. Component Items in each cluster.

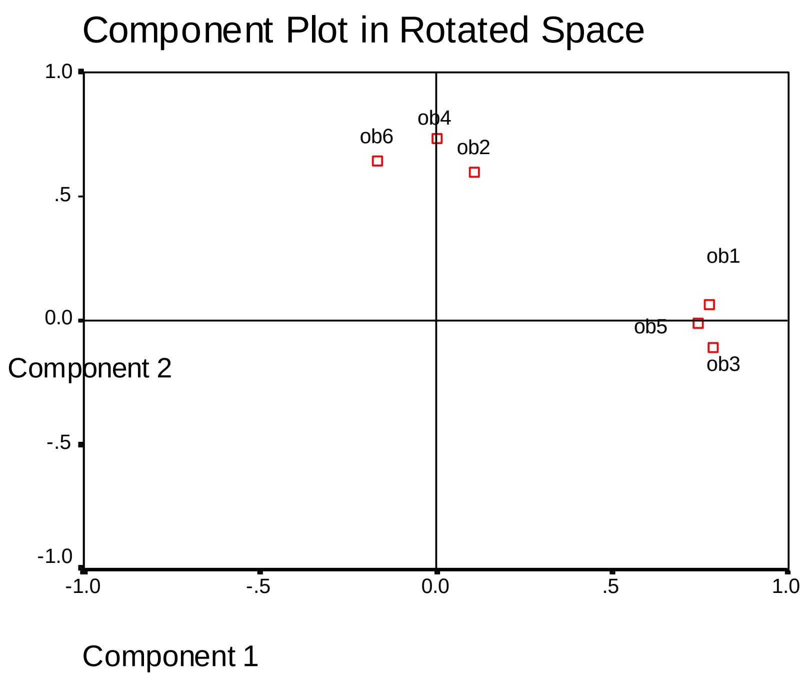


Table 104. Descriptive statistics for the Observable Behaviour Section of the MCQ (Original items prior to Principal components and factor analysis).

Item	Number	Median	Mode	Std Dev	Skewness	Kurtosis
OB1	*714*	*4*	*4*	*1.00*	*-.975*	*.280*
OB2	*709*	*3*	*2*	*1.03*	*.107*	*-1.029*
OB3	*715*	*4*	*4*	*1.19*	*-.397*	*-1.041*
OB4	*709*	*3*	*2*	*1.05*	*.139*	*-1.030*
OB5	*714*	*4*	*4*	*1.10*	*-.555*	*-.759*
OB6	*710*	*3*	*2*	*1.10*	*.031*	*-1.157*

Table 105. Descriptive statistics for the Values Section. (Original items prior to Principal components and factor analysis).

Item	Number	Range	Median	Mode	Std Dev	Skewness	Kurtosis
V1	*714*	*1-5*	*4*	*4*	*1.08*	*-0.72*	*-0.40*
V2	*712*	*1-5*	*4*	*4*	*1.08*	*-0.27*	*-1.01*
V3	*714*	*1-5*	*4*	*4*	*0.94*	*-0.89*	*0.31*
V4	*714*	*1-5*	*3*	*4*	*1.04*	*-0.04*	*-0.91*
V5	*711*	*1-5*	*4*	*4*	*1.04*	*-0.53*	*-0.64*
V6	*713*	*1-5*	*4*	*4*	*1.15*	*-0.66*	*-0.58*

Table 106. Principal components analyses for Values Section.

Item	Initial	Extraction
V1	*1.000*	*.615*
V2	*1.000*	*.651*
V3	*1.000*	*.632*
V4	*1.000*	*.585*
V5	*1.000*	*.610*
V6	*1.000*	*.610*
Extraction Method: Principal Component Analysis.		

Table 107. Total Variance for Values Section.

Item	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squarec Loadings		
Com	*Tot*	*% of Var*	*Cumul %*	*Total*	*% of Var*	*Cum %*	*Total*	*% of Var*	*Cum %*
1	*2.44*	*40.64*	*40.64*	*2.44*	*40.64*	*40.64*	*1.88*	*31.44*	*31.44*
2	*1.27*	*21.10*	*61.73*	*1.27*	*21.10*	*61.73*	*1.82*	*30.29*	*61.73*
3	*.68*	*11.31*	*73.05*						
4	*.58*	*9.65*	*82.70*						
5	*.53*	*8.87*	*91.56*						
6	*.51*	*8.44*	*100.00*						
Extraction Method: Principal Component Analysis.									

Table 108. Component Matrix for Values Section.

Item	Component	
	1	**2**
V1	*.521*	*.587*
V2	*.695*	*-.410*
V3	*.693*	*.389*
V4	*.607*	*-.466*
V5	*.654*	*.427*
V6	*.639*	*-.450*
Extraction Method: Principal Component Analysis.		
a2 components extracted.		

Table 109. Component Transformation Matrix for Values Section.

Component	1	2
1	*.728*	*.686*
2	*-.686*	*.728*
Extraction Method: Principal Component Analysis. *Rotation Method: Varimax with Kaiser Normalization.*		

Table 110. Descriptive statistics (Observable Behaviour Section) after Principal Components analysis.

1. Observable Behaviour Section	Median	Mode	Mean	SD
HOD Collegial behaviour cluster	**4**	**4**	**3.5**	**1.115**
(1) *The ship was very organised and the heads of department supervised each aspect of the ship's work closely. They did this to help people do their jobs well and improve crew morale.*	*4*	*4*	*3.7*	*1.009*
(3) *The heads of department met frequently with all members of their department to discuss problems and to praise members who had done well.*	*4*	*4*	*3.3*	*1.189*
(5) *The head of department usually demonstrated by personal example how things were to be done, but generally encouraged discussion and criticism of the procedures.*	*4*	*4*	*3.4*	*1.097*
HOD formalistic behaviour cluster	**3**	**4**	**3.1**	**1.065**
(2) *Ideas about the work to be done were discussed frequently within the department but solutions that did not concur with those proposed by the head of department were not accepted.*	*3*	*2*	*2.9*	*1.032*
(4) *People learned what to do by imitating the behaviour of the head of department. They also learned from non-verbal signals by them that discussion and criticism was frowned upon.*	*3*	*2*	*3.0*	*1.051*
(6)The members of the department thought that all the rules prescribed by the department were useless as the head never ever bothered to check whether anyone complied with them.	4	4	3.7	1.15

Key: (1) Clusters are as identified by the Principal Components and Factor analysis.

(2) Numbers in brackets indicate the original numbering as displayed in the instrument.

Appendix 16

Summary of respondents' responses to the outcome variables

Table 111. Summary of respondents' responses (raw data).

Nationality	No of respondents	No of accidents	No of responses to accident item	Collision	Grounding	Stranding	Fire	Contact	Injury	Other	Cause not given	Interesting	Complex	Repetitive	Simple
Australia	81	37	3	0	4	0	1	3	30	6	3	67	25	25	7
Bahamas	28	9	0	0	0	0	2	3	7	1	0	15	3	13	1
Bangladesh	5	1	0	1	0	0	0	0	0	0	0	3	2	1	1
Barbados	2	2	0	0	0	0	0	2	0	0	0	2	2	1	1
Belize	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Bermuda	2	1	0	0	0	0	0	0	1	0	0	1	0	1	0
Britain	123	47	1	0	4	0	8	2	35	5	1	83	29	60	18
Brunei	3	0	0	0	0	0	0	0	0	0	0	2	0	3	0
Cameroon	1	1	0	1	1	0	0	0	1	0	0	1	0	0	1
Cayman Is	2	1	0	0	0	0	0	0	1	0	0	1	1	0	1
China	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0
Cyprus	10	4	1	0	1	0	1	0	1	0	1	7	0	2	3
Denmark	3	0	0	0	0	0	0	0	0	0	0	2	0	3	1
Fiji	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Germany	11	0	0	0	0	0	0	0	0	0	0	6	6	0	1
Greece	3	0	0	0	0	0	0	0	0	0	0	2	2	0	1
Honduras	2	1	0	0	0	0	1	0	1	0	0	1	0	0	0
Hong Kong	23	6	1	0	0	0	1	0	2	3	1	13	0	9	2
India	35	8	6	0	2	0	1	0	3	1	1	21	9	14	3
Indonesia	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0
Iran	5	1	1	1	1	0	0	0	0	0	0	4	0	1	0
Israel	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Jamaica	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0
Japan	4	0	0	0	0	0	0	0	0	0	0	2	1	1	0
Korea	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0

Kuwait	5	1	0	0	1	0	0	0	0	0	0	3	0	2	1
Liberia	59	19	2	1	0	0	3	0	11	4	2	36	15	31	8
Libya	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Malaysia	79	27	1	1	2	0	6	2	16	6	1	32	21	36	9
Maldives	2	0	1	0	0	0	0	0	0	0	1	0	1	1	0
Malta	7	2	0	0	1	0	1	0	0	1	0	3	3	0	2
Marshall Is	3	0	0	0	0	0	0	0	0	0	0	2	1	0	0
Mauritius	2	0	0	0	0	0	0	0	0	0	0	2	0	2	0
NATO	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Netherland Antilles	1	1	0	0	1	0	0	1	0	0	0	1	0	1	0
New Zealand	4	2	0	0	0	0	0	1	1	2	0	3	1	1	3
Nigeria	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Norway	14	3	0	0	0	0	1	0	2	0	0	10	4	4	2
Pakistan	16	5	3	2	0	0	1	0	1	1	3	12	2	3	2
Panama	52	13	0	2	0	0	3	0	9	1	0	40	7	16	7
Papua New Guinea	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Philippines	25	1	0	0	0	0	0	0	1	0	0	17	6	8	0
Qatar	2	0	0	0	0	0	0	0	0	0	0	1	1	0	1
Saudi Arabia	9	2	0	0	0	0	1	0	0	1	0	3	1	5	2
Singapore	67	14	2	1	1	0	6	1	5	3	2	29	14	19	8
Sri Lanka	5	0	3	0	0	0	0	0	0	0	3	5	1	0	1
St Vincent	5	2	0	0	1	0	1	0	0	0	0	3	0	2	1
Sweden	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0

Switzerland	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*0*
Thailand	*3*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*1*
Tonga	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*	*0*	*0*
UAE	*3*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*1*	*1*	*0*
USA	*2*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*2*	*1*	*0*	*0*
Vanuatu	*3*	*1*	*0*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*3*	*0*	*0*	*1*
Vietnam	*2*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*1*	*0*
Western Samoa	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*
Not reported	*10*	*0*	*4*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*4*	*5*	*4*	*2*	*1*
Total	*738*	*220*	*29*	*10*	*20*	*1*	*38*	*15*	*134*	*37*	*23*	*461*	*168*	*274*	*92*

Table 112. Tonnage of the vessels that had accidents in the survey sample.

Statistical measure	**Tonnage**
Mean	51,417.72
Median	26,059.00
Mode	5,000.00

Appendix 17

Summary of accident injuries in survey sample

Table 113. Summary of accidents and injuries in the survey sample.

Department	Number of Accidents	Number of Injuries	Accidents % age of sample (n=714)	Injuries % age of sample (n=714)	Accidents % age of responses (n=199)	Injuries % age of responses (n=129)
Deck	*149*	*102*	*20.8%*	*14.3%*	*74.9%*	*79.1%*
Engine	*25*	*13*	*3.5%*	*1.8%*	*12.6%*	*10.1%*
Rating	*9*	*5*	*1.3%*	*0.01%*	*4.5%*	*2.6%*
Deck/Engine	*5*	*4*	*0.01%*	*0.01%*	*2.5%*	*3.1%*
Unknown	*11*	*5*	*1.5%*	*0.01%*	*5.5%*	*3.9%*

17.1.1 Description of sample

The sample population members reported sailing on vessels from fifty-eight different flag states. The tonnage of these vessels ranged from twenty-six tonnes to five hundred and sixty five thousand (565,000) tonnes. The Median size of the vessel sailed on was twenty-six thousand and fifty nine (26,059) tonnes while the Mode was five thousand tonnes and the Mean was fifty one thousand four hundred and eighty eight (51,488) tonnes.

The number of seafarers working aboard each ship ranged from a single person to nine hundred persons, the Median being twenty-five, and the Mode twenty-eight persons. The nominal stay or the period that was officially stated on a crew-person's joining papers, ranged from one day to thirty months. The Mode & Median nominal period for this sample was six months while the Mean was 6.01 months. The amount of time that seafarers actually spent on board, as distinct from the nominal period, ranged from three days to forty-eight months. The Mode and Median stay for this sample was six months, while the Mean was 6.88 months.

17.1.2 Summary description of the types of accidents reported by the sample's seafarers

Of the total sample, 199 respondents reported an accident whilst they were working aboard. This represented 27.9% (n= 714) of the total sample.

Twenty-nine respondents did not respond to this category in the instrument. Of the 199 accidents, 99 reported an injury that occurred as a result to seafarers, without stating the cause of the accident. The Table in Appendix 9 summarises the types of accidents reported. 10 of these were categorised as collisions and accounted for 5% of the total accidents reported (n= 199). 20 were groundings accounting for 10% of the total. 1 stranding was reported accounting for 0.05% of the sample; 38 were fires accounting for 19.1% of the sample. 15 were contacts or 7.5%, and 37 were categorised as other causes or 18.6% of the total sample. 134 incidents of injury were reported or 67.3% of the total. A technical description of each of the category of accident is contained in the 'Terms used in this Study' section, at the beginning of the thesis.

Of the 199 accidents reported in the study, 121 resulted in damage to the ship or 60.8% of the sample. Totally 129 injuries occurred or for every listed accident reported there were a 64.8% (n = 199) probability that injury would have resulted. The survey was unable to determine whether two respondents reported the same accident. 23 respondents did not identify any cause for an accident that they reported.

Of the accidents reported 149 (74.9% of responses) were from persons belonging to the Navigation department, 25 (12.6% of responses) from the Engine department and 5 (4.5% of responses) from the Rating department. 5 (2.5% of responses) reports were from persons who held joint Navigation/Engine Certificates of Competency, while 11 (5.5% of responses) seafarers did not state the department they worked for (See Table 112).

Of the injuries reported 102 (79.1% of responses) were from the Navigation Department, 13 (10.1% of responses) from the Engine Department and 5 (2.6% of responses) from the Rating Department. 4 (3.1% of responses) reports came from persons holding a joint Navigation/Engine Certificates of

Competency and 5 (3.9% of responses) did not state which department that seafarer worked for.

The respondents also reported that 461 (62.5%) of them found their job interesting, 274 (37.1%) found it repetitive, 168 (22.8%) complex; while 92 (12.5%) seafarers found their jobs simple to perform. It should be noted that respondents could respond to more than one category. For a complete description and details of all the reported accidents see Appendix 16.

Appendix 18

A detailed description of the accidents described by sample respondents

Narrative of accidents described by sample respondents

84 of the 220 respondents elaborated on the causes of these accidents. Three respondents made comments unrelated to the details of an accident, and so were not reported in the paragraphs below. Table 113 contains a summary of the number and type of incidents that occurred.

A total of nine oil pollution incidents were reported. Of the nine, two related to the spillage of bunker or fuel oil on a ship. The remaining seven related to the spillage of oil carried as cargo. One of the bunker oil spills occurred as a result of the concerned persons over reliance on the readings of a faulty gauge. Another incident occurred when the ballast tanks of a ship overflowed during operations; as a result the ship was fined.

The overflow of chemicals on deck during cargo operations was another reported incident. A further consequence was that the chemical sprayed on to crewmembers in the vicinity of the breach point, resulting in injuries to some of them. The last spillage report concerned the overflow of part of a cargo of vegetable oil on the deck of a ship, during cargo operations.

Two incidents of near drowning were reported. The first incident occurred when two people were assigned to do some work in a ballast tank and whilst in there someone opened the inlet valves of the tank to flood it, the two escaped without being harmed. Another respondent experienced a similar incident though this occurred when that person was assigned work in a duct keel. The difference between the two incidents was that the person who ordered the duct keel flooded knew that a person was working in the concerned space. Luckily an unfortunate consequence did not eventuate as a result of this apparent lapse of memory.

Some respondents reported damage to the ship on which they were working. In one instance, the gantry crane of the ship was damaged. This incident occurred when after completing a re-fuelling operation the bunker-barge cast off from the larger vessel and started to move away.

Table 114. Summary of incidents reported by the sample.

Categories	Sub-categories	Number of incidents
Pollution		
	Fuel Oil Pollution	2
	Oil cargo spillage	8
	Chemical overflow	1
Damage		
	Heavy weather	1
	Ship crane	2
	Oil loading boom	1
	Cargo Damage	2
	Ship damage	3
Grounding		2
Collision		3
Sinking		1
Fire		10
Injury		37
Near drowning		2

The departing vessel's mainmast struck the overhanging boom of the gantry crane of the larger vessel. The cause of the incident was the failure of the barge master to notice the boom obstructing the barge's path.

The excessive ranging of an oil tanker along its berth while loading cargo caused one of its mooring lines to break. The additional movement that this afforded to the vessel caused the attached oil-loading boom to break. In another similar incident, a shore worker was injured on being struck by a lifting strap that broke whilst an oil loading hose was being hoisted aboard.

Two respondents reported the grounding of the vessel on which they sailed. The wording used in the first case indicated uncertainty as to whether or not the incident occurred at all. The report also did not contain any further details of the resultant damage that may have occurred to the ship. The second account reported that high wind, a falling tide and strong channel currents contributed to the grounding of that seafarer's vessel.

In other reports, a vessel collided with a pier whilst coming alongside, while another ship hit a quay wall in similar though foggy circumstances. A tug was the casualty in another berthing operation when it collided with the vessel it was tending. In another incident a vessel struck and ripped out a log boom buoy. The inability of the engineers to alter the power settings of a vessel's main engine stuck in the 'full-ahead manoeuvring' position, being the main attributable cause. A dragging anchor caused one vessel to drift on to another 7 cables (0.7 of a nautical mile) away. In this incident the watch-keeper on the dragging vessel was asleep and failed to take appropriate action.

In one of three other incidents a ship almost capsized as a result of high winds. Consequently two containers were lost overboard whilst another container got damaged. In another case, a vessel lost some containers but the cause of the incident was unclear. One respondent reported the sinking of a ship, with the loss of 16 lives and 9 survivors. The circumstances that gave rise to this sinking however were not stated.

Other damages that some vessels sustained were the loss of an anchor in one instance, and the explosion of a generator in another. Another ship damaged its cargo hold when an improperly secured hatch pontoon fell in. In one incident a vessel's main-engine failed when its steam pipes burst. Another ship's windlass blew up, while another incident reported damage to a vessel's anchor winch block. A ship's cargo crane was damaged whilst loading cargo. Another incident reported the dropping of cases of beer on the deck of a ship. In all of the above instances the respondent did not provide any further details of the respective incidents. Another respondent reported a major accident without giving any details.

Two incidents concerning a tank ship's pumproom were reported in the sample. The first was its flooding as a result of leaking cargo lines during cargo operations. The second incident reported the injury of a person who fell some distance (6 metres) to the floor of the pumproom.

18.1.1 Incidents that involved fire.

The following is a summary of the fires described by respondents, Table 113 contains this information in tabular form.

A fire occurred in the safety locker whilst a vessel was in dry dock. A scavenge space fire was reported in another incident, whilst a crankcase explosion disabled the main engine of a ship in another. Also in the engine room, a fire occurred as a result of oil leaking in a generator's turbocharger, whilst the vessel was in dry dock. Another fire broke out when some cables caught fire because of welding activity in the vicinity. In another incident welding caused accumulated garbage aboard the ship to catch. One respondent reported a fire occurring on board without further elaboration. While another reported an engine room fire without further details, there was also another similarly sparse report of a galley fire. Another incident of many small but controllable fires was reported without further elaboration.

Sulphur caught fire whilst being discharged from a cargo hold. Wood was another commodity that caught fire in a different incident with no further details. Similarly in another incident switchboard damage occurred as a result of the fire, without further elaboration.

In one incident the violent rolling of a ship caused a couch to break free. The couch then slid across a space and struck a cabinet injuring two women; many other unfastened items were also damaged as a result. The author of this report revealed that another similar incident occurred nineteen hours prior to the one described above.

Of the 87 reports, 37 of them reported injuries occurring to people. The following is a summary of these injuries:

A fight on board ship resulted in a seafarer being stabbed. An engineer's back broke when that person fell in the engine-room, whilst another person's back was crushed between hydraulic doors in another incident. Two other reports described back injuries occurring to two seafarers, but they did not elaborate on the causes. Chipping rust off part of the ship's structure could also prove hazardous as it was cited as the cause of an eye injury occurring to a seafarer. Another seafarer's eye was damaged on being impacted by the spray of acid from a ruptured cargo pipe. There were three general reports of injuries occurring to seafarers but none of them specified the type or cause of the injury. One report merely reported a person falling down but gave neither the cause nor the consequence of this incident. A gangway hoist struck and injured a seafarer's head; consequently, this person remained unfit for work for a period in excess of 12 months.

Another person's hand was injured whilst cutting a rope, and another respondent reported a general cut occurring to the hand of a seafarer without stating the cause. In a different incident, a rating's thumb was severed whilst this person was handling stores. A mooring rope was cited as the cause of injury when it struck a seafarer during berthing operations. In another unrelated, though similar incident, a seafarer lost half a finger during berthing operations; the cause was however not stated. A cadet's finger was severed when it came between a wire and the sheave groove of a gangway block. A fitter was also the reported recipient of a moderate cut; the cause was however not stated.

The engine room of a ship can be a hazardous place, as an Engineer was reported to have injured a finger whilst working in the Oil Purifier room. In another mishap, an angle grinder ripped the tendons in an engineer's wrist. The tip of another person's finger was severed whilst that seafarer was working in the engine room.

A rating fell through a hatch opening to the deck below and was injured. This incident occurred whilst the seafarer was shifting garbage bins. The strain of lifting a leaking turpentine container proved too much and caused injury to a Rating's back. One incident reported a person suffering as a consequence of inhaling a noxious gas, whilst injury occurred to another seafarer's knee; no cause for the incident was given. Two other reports in the survey also did not cite any cause for the occurrence of an incident. The consequences however were injury in the first case and the death of a seafarer in the second. There were three reported incidents of people being lost overboard whilst the vessel was at sea.

Appendix 19

Images of School through Metaphor – Actual (ISMA) Instrument

Table 115. Images of School through Metaphor – Actual (ISMA) Instrument.

My school is a/an

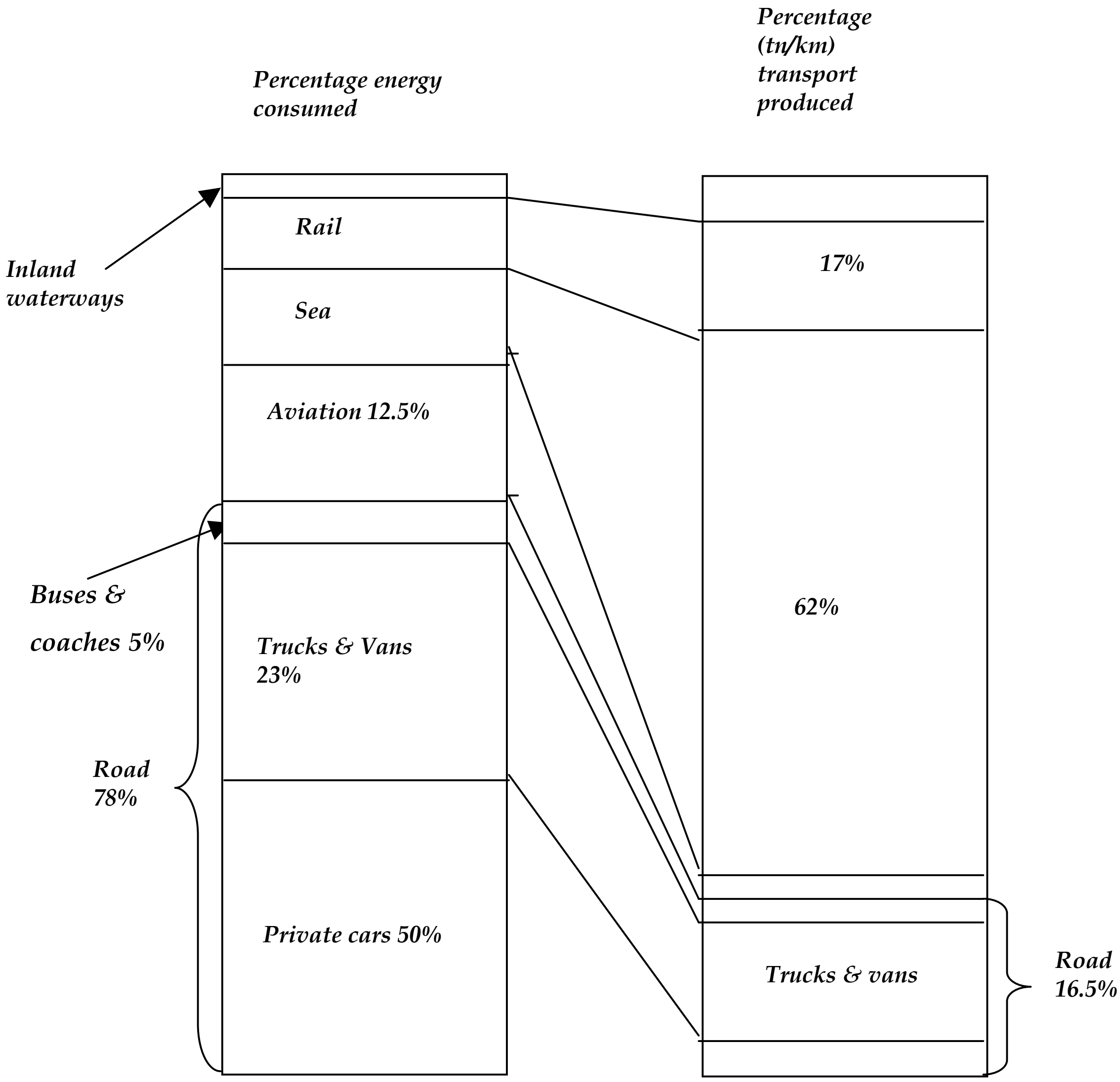
Culture	Military camp
Herd	Ghetto
Family	Artist's palette
Forum	Machine
Exhibition	Expedition
Orchestra	Team
Hospital	Traffic jam
Creche	Negotiating area
Museum	Prison
Garden	Olympic games
Mental strait jacket	Living organism
Shopping mall	Theatre
Beehive	Labour ward

(Grady, 1996)

Appendix 20

Figure depicting energy consumption related to transport of goods

Table 116. Western World transport 1975: energy consumption related to transport of goods.



(Harris & Simmonds, 1979)